PART X.

THE ORGANS OF SENSE, AND VISCERA OF THE THORAX AND ABDOMEN.

A

SYSTEM

OF

ANATOMICAL PLATES,

ACCOMPANIED WITH DESCRIPTIONS,

AND

PHYSIOLOGICAL, PATHOLOGICAL, AND SURGICAL

OBSERVATIONS.

BY

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IN ADMIRATION OF THOSE

DISTINGUISHED SURGICAL TALENTS,

WHICH HAVE

CONTRIBUTED TO RAISE THE MEDICAL SCHOOL OF DUBLIN

TO ITS PRESENT ELEVATION,

AND TO EXTEND ITS CELEBRITY OVER THE WORLD,

THIS PART IS INSCRIBED,

BY HIS VERY OBEDIENT AND VERY HUMBLE SERVANT,

THE AUTHOR.

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ORGANS OF SENSE.

THE EYE.

In Plate X. of Part IX., and in Plates XI. and XII., this important organ is delineated. In order to simplify its description, the eye is divided into several departments, as the bones which compose the orbit, the external appendages, the eye-ball, the muscles, the nerves, and the blood-vessels. The orbits are of a conical figure, with their apices looking centrad or towards the brain, their bases peripherad or outwards, their internal or mesial sides running nearly parallel with each other, and their external or lateral sides divaricating.

The bones composing the orbit in which the eye and its appendages are contained, are the frontal, the lachrymal, the ethmoid, the superior maxillary, the malar, the sphenoid, and the palatine, making in all seven in number, as represented in *Fig.* 1 of Plate IV. of Part I. The orbit is invested with the periosteum, here named periorbita, which is continuous with the periosteum of the bones of the face, and with the dura mater that lines the interior of the bones of the cranium. The various foramina, as the optic, the anterior rugged or sphenoidal, the

spheno-maxillary, and the anterior and posterior internal orbitary, which give entrance to the different nerves and blood-vessels that supply the eye, are situated at the bottom of the orbit, as represented in *Fig.* 1 of Plate IV. of Part I.

The external appendages of the eye are, the supercilium, with its corrugator; the palpebræ, which consist of the common integuments, with very delicate cellular substance, the orbicularis palpebrarum, the tarsi, with their ligaments, and the tunica conjunctiva palpebrarum; the cilia; the glandulæ ciliares; the glandula lachrymalis; the caruncula lachrymalis; the lacus lachrymalis; the plica semilunaris; the puncta lachrymalia; the canaliculi lachrymales; the saccus lachrymalis, and the ductus lachrymalis.

The supercilium or eye-brow, marked S in *Fig* 1 of Plate X. of Part IX., is that elegant arrangement of hairs, situated on the integuments which cover the superciliary ridge of the frontal bone, forming an arch above the eye, and giving much expression to the countenance. These hairs are short, and consist of two series, the inferior of which runs upwards and outwards, while the superior downwards and outwards. Beneath the integuments there is a considerable quantity of adipose substance; and beneath this are the united fibres of the occipito-frontalis and orbicularis palpebrarum muscles; while underneath all, close to the pericranium, is the muscle which moves this arrangement of hairs, named corrugator supercilii.

The corrugator supercilii* muscle, represented in *Fig.* 2 of Plate X. of Part IX., marked *s*, situated on the superciliary ridge of the frontal bone, derives a fleshy

* Syn. Est qui sub cute supercilii: An pertinet ad supercilii musculum: Corrugator: Musculus frontalis verus, seu corrugator: Surcillier: Fronto-surcillier: Cutaneo-surcillier.

origin from the inner or mesial aspect, near the internal angular process, and extends along the ridge nearly two-thirds, when the fibres mingle with those of the orbicularis palpebrarum w, and the occipito-frontalis q muscles, so as to constitute its insertion. The function of this muscle is indicated by its name; it is employed in knitting or corrugating the eye-brows.

The palpebræ or eye-lids are each of a crescentic figure, or resemble the segment of a circle, the straight line of which forms the edge, so that when they are gently shut they form a complete circle. They are slightly convex outwardly, and gently concave inwardly, and are so adapted as to shut the anterior entrance of the orbit. Each palpebra consists of the common integuments, which are remarkably thin; of a little delicate cellular membrane, there being little or no adipose substance; of the fibres of the orbicularis palpebrarum muscle; of an oblong cartilage, named tarsus, which constitutes its chief portion; of cilia or eye-lashes; of ciliary glands; and of the tunica conjunctiva palpebræ.

The orbicularis palpebrarum has been already described in Part IX., page 36, and is delineated in Plate X. of Part II., marked w.

The tarsi are thin fibro-cartilaginous bodies, firm and elastic, of an oblong shape, broader in the centre than at the extremities, and thicker at their margins where they look to each other, being so constructed that their exterior or peripheral edges meet, while their interior or central edges are so far apart as to leave a triangular canal when the eye-lids are shut, and even when open an angular fossa at the margin of the lower eye-lid to conduct the tears. The tarsus forms the chief portion and strength of each eye-lid, on which the skin, the muscular fibres, and tunica conjunctiva, are stretched. The tarsus of

the upper eye-lid, marked T in *Fig.* 1 of Plate X. of Part IX., is larger and broader than that of the lower one, marked t in the same figure, both being invested, however, with the tunica conjunctiva, in consequence of their being everted. The inferior tarsus is not only narrower to correspond with its eye-lid, but is nearly of the same breadth throughout.* The tarsus of the upper eye-lid is supported in its situation by a ligamentous production, formed by the union of the periorbita and pericranium, which is attached to its orbital edge; while that of the lower eye-lid is supported by a similar production, formed by the union of the periorbita and periosteum, covering the superior maxillary and malar bones, and attached also to its orbital margin. These are named by some the broad ligaments of the tarsi, and are strongest at the outer or temporal canthus of the orbit. The two tarsi also have a ligament common to them, of a round shape, marked *t* in *Fig.* 2 of Plate X. of Part IX., extending from their inner or mesial extremities to the nasal process B of the superior maxillary bone.†

The cilia or eye-lashes are an elegant arrangement of stiff hairs, of a semicircular or arched shape, projecting from the outer edges of the margins of the eye-lids; those of the superior curving downwards and upwards, having their convexity looking downwards; while those of the inferior curve also downwards, but have their convexity pointing upwards, so that when asleep they interlace each other. The cilia of the upper eye-lid differ

* The shape of the tarsi should be thoroughly investigated, as the eye-lids are subject to many diseases, and require many operations. There are inversion or entropeon, eversion or ectropeon, and various tumours situated on the eye-lids, all of which generally demand an operation.

† Syn. Ligamentum palpebrale. The relation of this ligament to the lachrymal sac G, should be considered by the surgeon when operating for fistula lachrymalis.

from those of the lower in being longer and stronger, and in the central ones being also longer and stronger than those at the angles of the eye. Each eye-lash originates by a slender root from the integuments, becomes gradually thicker in the middle, and then tapers to a very fine point.*

The apertures of the ciliary glands,† or rather the ducts of these glands, which are placed on the inner surface of the tarsi, and covered by the tunica conjunctiva, are observable immediately within or centrad to the eye-lashes. The glands themselves are arranged transversely on the tarsi, as represented in *Fig.* 1 of Plate X. of Part IX., running in longitudinal parallel rows, or rather clusters, of a yellowish colour. When examined with a magnifying glass, each tube or row consists of a congeries of very minute roundish-shaped glands, each of which pours out its unctuous secreted fluid into its excretory tube, which runs in the centre of these small glands, and terminates by the open aperture at the ciliary margin of the eye-lid. These apertures are named the ciliary ducts. It is calculated that there are between thirty and forty rows of these small glands in the upper, and a few less in the lower eye-lid: in the former they are longer than in the latter.‡

The glandula lachrymalis, marked *g* in *Figs.* 2, 3, and 4 of Plate X. of Part IX., and in *Fig.* 1 of Plate XI. of Part X., situated at the outer and upper aspect of the

* The eye-lashes frequently take a different direction, and require an operation to be performed on the eye-lids; their natural course, therefore, should be well understood.

† Syn. Meibomian glands: Glandulæ sebaceæ palpebrarum.

‡ The ciliary glands are frequently diseased, and also lay the foundation of diseases of the contiguous organs; they are involved in ophthalmia of the conjunctiva palpebrarum, in psorophthalmy, in lippitudo, in hordeolum, in inflammation of the canaliculi lachrymales, of the lachrymal sac, and also in fistula lachrymalis.

orbit, near or within the external angular process of the frontal bone, adhering to the periorbita, (the depression being marked *k* in *Fig.* 2 of Plate V. of Part I.,) is a conglomerate gland of a somewhat oval shape, of a firm texture, and of a greyish ruddy colour, so that it is easily distinguished from the delicate soft adipose substance which abounds so plentifully in the orbit. Seven or eight short excretory ducts, leading from this gland, open like small lacunæ through the tunica conjunctiva palpebræ, and from which a few tears can be pressed when the eye is recent.* By some authors this gland is described as double, and named glandula lachrymalis superior seu innominata Galeni, and glandula lachrymalis inferior.

The caruncula lachrymalis, marked C in *Fig.* 1 of Plate X. of Part IX., situated at the inner angle of the eye, between the eye-lids, is a small conglomerate gland, of a reddish colour and prominent appearance, studded with short bristly hairs, and is more distinctly seen in the living than in the dead state. When examined in the latter state, it is found to be a congeries of glandular bodies, similar in structure to the ciliary glands.†

The lacus lachrymalis is a delicate channel or fossa, situated around the caruncle.

The plica semilunaris,‡ marked P in *Fig.* 1 of Plate X. of Part IX. is a delicate crescentic-shaped mucous membrane, situated a little nearer the eye-ball than the caruncula, the cornua pointing upwards and downwards, the convexity

* The lachrymal gland is seldom diseased; it is subject, however, to increased secretion, constituting epiphora; to inflammation, particularly the chronic, which occasionally terminates in schirrus and cancer; also occasionally to acute inflammation and suppuration, and to encysted lachrymal swelling, and to watery vesicle of the gland. It is likewise subject to other sarcomatous tumours.

† The caruncula lachrymalis is subject to inflammation, suppuration, abscess, encanthis, and pterygium.

‡ Syn. Troisième paupière.

towards the caruncle, and the concavity towards the cornea; it resembles the membrana nictitans in birds.*

A small aperture, marked *p* in *Fig.* 1 of Plate X. of Part IX., named the punctum lachrymale, is observable near the caruncula lachrymalis, on the margin of each eye-lid, at the extremity of the tarsus, with a slight elevation around, which is termed the papilla lachrymalis. Each punctum is the outer commencement of a slender little mucous tube, named canaliculus lachrymalis,† which leads into the lachrymal sac; and in *Fig.* 2 of Plate X. of Part IX., the bristles marked 1, 2, are inserted in these tubes, and seen converging and emerging from the sac G. The two canaliculi enter conjointly into the sac, or have a common inner opening, a tubulus communis, immediately beneath the ligament of the tarsi. Rosenmüller describes a little valvular fold covering this termination of the canals; but this I never could observe. The superior canaliculus runs more perpendicularly than the inferior, and both on a very gentle declivity, which, however, is modified by position, and each is about a quarter of an inch in length. The superior runs downwards and inwards, but the inferior is described by authors as running upwards and inwards.

The lachrymal sac G, situated at the nasal angle of the eye, and attached to the nasal process of the superior maxillary and lachrymal bones (see *Fig.* 1 of Plate IV. of Part I.), is a fibro-ligamentous pouch, of an oval shape, about the size of a small horse bean, lined with a pulpy mucous membrane, containing numerous small mucous cryptæ, and giving entrance to the canaliculi lachrymales, and forming the beginning of the lachrymal or nasal duct.

* The plica semilunaris is involved in the same diseases as the caruncula lachrymalis.

† Syn. Cornua limacum.

It is rounder superiorly than inferiorly, from its contracting to form the nasal duct, there being a slight constriction where the duct begins. This duct is formed of the lachrymal, superior maxillary, and inferior spongy bones, as described in page 53 of Part I., and delineated in *Fig.* 1 of Plate IV., and in *Figs.* 17, 16, 27, and 28 of Plate VI., and is lined with a pulpy mucous membrane continuous with the Schneiderian membrane of the nares, and with the tunica conjunctiva of the eye, and like the former containing numerous small mucous cryptæ; the mucous membrane lining the canaliculi and their puncta being, however, more compact and thinner. There is thus a connexion established between the eye and the nose by continuity of mucous surface through the medium of these lachrymal passages. In *Fig.* 3 of Plate V., and *Figs.* 1 and 2 of Plate VI. of Part IX., the course of this duct is developed. The bristle marked 3 in these figures, is inserted in this duct, and from these it is observed that the tube runs obliquely downwards and backwards. This duct is fully half an inch long, and sufficient to admit a bougie a little larger than a crow quill. *Fig.* 3 of Plate V. exhibits an interior section of the right naris, the digits 23 indicating the inferior spongy bone, which in *Fig.* 1 of Plate VI. is partially removed, and in *Fig.* 2 of the same Plate it is cut up towards the narrow part of the duct. This nasal duct, therefore, is a narrow tube, having two large terminations; the superior the lachrymal sac, and the inferior this dilatation, where it ends in the naris.* About the middle of the duct, a loose fold of the mucous membrane is de-

* The lachrymal passages, or the canaliculi, saccus, et ductus lachrymales, are subject to inflammation, to increased mucous secretion or blenorrhœa, vitiated secretion, stricture, fistula, hernia, and absolute obstruction; thus resembling the urethra in its diseases.

scribed by Soemmering as occurring in many subjects, but this appears to be the result of disease.*

After the investigation of the appendages, I shall examine the tunics of the eye, which are divided into the proper and the accessory; the former consisting of the sclerotic, choroid, and retina, and the latter of the conjunctiva, cornea, and iris. I shall begin with the accessory; and in the first place, with the tunica conjunctiva.

The tunica conjunctiva† is the semi-pellucid mucous membrane, with a polished surface, which invests the eye-lids and anterior surface of the ball of the eye. This membrane consists of all that surface of the eye which is exposed in *Fig.* 1 of Plate X. of Part IX.; the eye-lids being everted. It commences at the margins of the eye-lids T, t, being a continuation of the skin; invests both eye-lids, running over the ciliary glands; and is reflected over the anterior aspect of the eye-ball, the caruncula lachrymalis, and plica semilunaris, so as to form a continuous or uninterrupted surface. Its adhesion to these objects is cellular. Where it begins to be reflected from the eye-lids, over the eye-ball, or vicê versâ, there is a doubling or loose fold or angle, which can be unfolded, so as to exhibit one extended smooth surface, by everting the ball of the eye out from the eye-lids. That portion of this membrane which invests the eye-lids is named tunica conjunctiva palpebrarum vel palpebralis, while that which covers the anterior aspect of the eye is termed tunica conjunctiva oculi, this latter being divided into conjunctiva corneæ and conjunctiva scleroticæ. Where the conjunctiva begins, it is pierced by the ciliary ducts; and where it passes over

* Where the lachrymal duct terminates in the nostril, stricture is said to occur most frequently.

† Syn. Tunica albuginea: Tunica adnata.

the caruncula lachrymalis, it is pierced by its ducts and hairs. By the majority of writers, the conjunctiva is considered as terminating around the outer margin of the cornea or transparent membrane of the eye; but its extension over the cornea is established by its being capable of being separated when the eye is a little putrescent,—by its acute sensibility, in which it differs from the cornea,—by the blood-vessels of the conjunctiva sclerotica extending over the cornea,*—and by analogy with the lower animals, the serpent tribe for example, shedding the conjunctiva corneæ at the same time with the epidermis. The conjunctiva which covers the cornea is perfectly transparent; no vessels can be seen on it; it is thinner than the sclerotica, and adheres most intimately to the external surface of the cornea. The conjunctiva sclerotica is thick and pulpy, of a white colour, has few or no red vessels on its surface, and adheres by loose cellular substance to the sclerotic coat, so as to enable the ball of the eye to move in all directions.†

The conjunctiva palpebrarum‡ is semi-transparent, extremely vascular,§ and of a reddish colour; it is thinner than the sclerotic portion, but thicker than the corneal; and it adheres loosely to the tarsus, where it leaves the sclerotica, but more and more firmly onwards to the ciliary margin, where they become consolidated.

The cornea‖ is the anterior transparent tunic of the eye, marked *f* in *Figs.* 1, 3, 5, 6, 8, and 10, *Figs.* 3 and

* This should be considered with reference to inflammation of the conjunctiva palpebralis and sclerotica, and also with respect to pterygia.

† The folds of the conjunctiva are sometimes the seat of serous effusion in inflammation of this membrane of the eye.

‡ Conjunctiva palpebralis.

§ The high vascularity should be kept in view in inflammation of this membrane.

‖ Syn. Cornea lucida: Cornea pellucida.

5 being magnified views of *Figs.* 2 and 4; it is a thick convex tunic, resembling the convex glass of a very small watch, and, with the sclerotic *s*, it forms the exterior case or stratum of the eye-ball. The eye-ball is not perfectly spherical, the line forming the visual axis exceeding its transverse diameter. It consists of several laminæ, loosely connected together, which can be developed by squeezing the cornea between the finger and thumb, or by incising the cornea, and separating the laminæ with the forceps, each lamina being found to consist of a fibro-cartilaginous structure.* The cornea is covered with the tunica conjunctiva, and is considered invested on its internal concave surface with the membrane of the aqueous humour. The cornea forms a pretty regular portion of a sphere, and is of equal thickness throughout, its refractive power being found to be greater than that of water.

The iris, marked *i* in *Figs.* 3, 5, 6, and 7 of Plate XII. of Part X., extending from the letters *f* onwards to the black circle in the centre, is that beautiful circular membrane stretched across the eye, which produces such diversity of expression in each countenance, according to the difference of its colour. It extends from the ciliary circle or ligament,† which is the circle of union of the cornea *f*, sclerotic coat *s*, and ciliary folds, across or centrad in the

* The thickness of the cornea, and its consisting of layers thus adhering and sliding on each other, should be kept in view by the operator, otherwise he will have no conception of its structure when he comes to perform either anterior reclination of the lens, keratonyxis, or extraction of the lens. We cannot lacerate the cornea either with the fingers or the forceps.

† Syn. Annulus gangliformis tunicæ choroidæ: Annulus ligamentosus: Orbiculus ciliaris: Plexus ciliaris: Commissure de la choroïde. It is of considerable importance in operative surgery to be aware, that at this point, where the cornea and sclerotic coat are united, the ciliary processes and iris also are connected, and likewise that the ciliary processes adhere to the vitreous humour, and capsule of the crystalline lens. This connexion is clearly displayed in *Figs.* 4 and 5, the latter being an enlarged view of the former.

aqueous humour, in which it floats, having an aperture nearly in its centre, named the pupil, marked *p* in *Figs.* 3, 5, and 7, which varies in magnitude in the living state, according to the comparative intensity of the light. The iris appears a congeries of blood-vessels, and is supposed to be muscular; its anterior surface presents a beautiful stellated appearance, or representation of some wicker-work, and varies in colour in different individuals; while its posterior or central surface is said to consist of a circular arrangement of fibres; but this appears incorrect. In *Fig.* 7 of Plate XII., which is a posterior view of the iris, its arrangement is also radiated. The colour of this surface is always a uniform dark brown; it is a thick stratum of the pigmentum nigrum, and is named uvea. The outer circular margin, which adheres to the ciliary circle, is named its ciliary; and the border of its central aperture is termed its pupillary margin, which is thin and sharply defined, and always of a dark colour, being covered with pigmentum nigrum, or by the uvea. The pupil is not precisely in the centre of the iris, the nasal being narrower than the temporal side. In the fetus, it is filled up with a delicate vascular opaque membrane, termed the membrana pupillaris, which begins to disappear about the seventh month.

The tunica sclerotica,* marked *s* in *Figs.* 1, 3, 5, 6, 8, and 10, is the hard thick and bluish-white coat which forms the greater portion of the external stratum of the eyeball, extending from the cornea to the optic nerve 2, the latter of which pierces it in minute filaments, so as to form small foramina. This tunic is also pierced by the ciliary nerves *c*, arteria centralis retinæ *k*, with its concomitant vein *z*, the ciliary arteries *d*, and the ciliary veins *h*, as represented in *Figs.* 1, 5, 8, and 10. The sclero-

* Syn. Cornea opaca, seu tunica albuginea.

tic can only be separated from the cornea by long maceration. It is so firm in its texture, which is fibrous, that it retains its figure when the humours are evacuated or removed, and we cannot lacerate it with the fingers or forceps. It is somewhat thinner anteriorly than posteriorly, and its external surface is rough and cellular, affording insertion to the muscles of the eye-ball, while its internal surface is smooth and glistening, being lined by the choroid coat.

The choroid coat,* marked *b* in *Figs.* 5, 8, 7, 9, 10, and 11, is the soft thin delicate vascular membrane immediately interior or centrad to the sclerotic coat, which it invests, extending from the optic nerve 2 onwards to the crystalline lens *l*, in *Figs.* 4, 5, and 9. Its surface, which adheres to the sclerotic coat, as displayed in *Fig.* 8, is named pigmentum nigrum;† but this colouring matter pervades its whole structure, and is evidently an adventitious substance. The surface looking centrad or adhering to the retina *r* in *Fig.* 10, is termed, after Ruysch, tunica Ruyschiana; but in the human eye we cannot separate the choroid coat into two layers, as in the ox and many other animals. The whole texture of the choroid coat is a congeries of blood-vessels, as clearly exemplified in *Fig.* 8, with this brown adventitious pigment, for it is brown in man. Posteriorly, the choroid coat is pierced by the filaments of the optic nerve, the arteria centralis retinæ, with its accompanying vein, and some of the ciliary arteries. On tracing the inner or central surface of the choroid coat from the optic nerve onwards to the crystalline lens, as displayed in *Figs.* 4, 5, 7, and 9, we observe, that at some distance before arriving at the lens, it forms a number of parallel loose folds, radiating around

* Syn. Tunica vasculosa oculi.

† Syn. Pigmentum fuscum.

the lens, which are marked *m*, and which constitute what is named the ciliary zone;* the small apices or points of which that adhere to the capsule of the lens, and project into the posterior chamber of the aqueous humour, as represented in *Fig.* 6, and marked *n*, are termed the ciliary processes.† In *Figs.* 4 and 5 the choroid coat is invested with the retina.

These ciliary folds or plicæ *m*, as seen in these figures, are observed to constitute nearly one-fourth of the choroid coat; and in *Fig.* 4 a peculiar dark ring or areola is perceived immediately before these plicæ begin to be formed. The processes, where they project into the anterior chamber, are also darker. The print or impression of these plicæ on the vitreous humour is delineated in *Fig.* 12, the humour being marked *o*, and the impression with which always some of the plicæ remain, is marked *m*. These folds consist of the same structure as the rest of the choroid coat, being fully more vascular and more plentifully supplied with nerves.

The retina *r*, *Figs.* 10, 11, 4, and 5, is the delicate medullary expanse of the optic nerve, which lines the choroid coat, being situated between it and the vitreous humour. In *Figs.* 4 and 5, which are vertical sections of the eye, *Fig.* 5 being a magnified view of *Fig.* 4, we observe the optic nerve 2 becoming singularly constricted, reduced nearly to one-third, piercing the cribriform spot of the sclerotic *s* and choroid *b* coats, and expanding in a delicate pulp-like mucilage over the choroid coat and ciliary zone *m*, dipping between the plicæ so as to invest the whole, onwards to the capsule of the

* Syn. Corpus ciliare: Tunica ciliaris.

† Syn. Corona ciliaris: Ciliary ligament: Rayons sous-iriens. "In regard to the names appropriated to this part of the eye," says Mr. C. Bell, "there is more confusion than it is possible to believe."

lens *l*, where it terminates. By most authors it is allowed to consist of two substances or two layers, a medullary expansion of the nerve, and a vascular membrane supporting it; but some consider this vascular layer to be internal or central to the medullary, while others hold the reverse. Dr. Jacob, of Dublin, has lately attempted to demonstrate a third layer, which he considers a distinct membrane of the eye, alleging, "that the retina is covered on its external surface by a delicate transparent membrane, united to it by cellular substance and vessels." But this appears to be nothing more or less than the membrane described by Monro secundus, who in his description of the retina observes, "The whole or retina appears to be composed of a uniform pulpy matter, on the outer side of which chiefly vessels are dispersed, supported, I suppose, by a *membrane* the same or analogous to the pia mater." The retina adheres by extremely delicate cellular substance both to the choroid coat and to the vitreous humour. In *Fig.* 10 delicate blood-vessels are seen ramified on the exterior or choroid surface of the retina; and in *Figs.* 4 and 5 the arteria centralis retinæ *k*, with its vein *z*, is observed running in the centre of the section of the optic nerve 2, and entering at what is termed the porus opticus. In *Fig.* 11 the artery is seen radiating over the internal surface of the retina, or that which adheres to the vitreous humour. In this last figure also a delicate conical papilla, or process, or fold, is observable, marked S, with the foramen* and delicate zone of Soemmering, of a pinkish colour around. By Soemmering the latter is said to be yellow. This process or fold is supposed by Sir E. Home to be the production of art, which appears correct; for when we cautiously make a horizontal section

* Syn. Foramen centrale.

of the eye, leaving as much as possible of the vitreous humour, we do not see this process. Meckel contends, that it is more palpable in the fetus than in the adult; but remarks, however, that he has observed no foramen here, but only a spot almost entirely deprived of medullary substance, of an oval figure, and which is surrounded with a free border neatly cut; and that this spot is not very apparent unless we compress the vitreous humour, so as to repress the process around or without, and to efface it. The retina is transparent in the living, but opaque in the dead state.

The optic nerve does not enter in the centre of the sphere, but a little towards the inner or mesial or nasal aspect, as is best illustrated in *Fig.* 1 of Plate XI. of Part X. This nerve is invested with a production of the dura and pia mater. The former terminates at the sclerotic, to which it intimately adheres, but does not form the sclerotic, as described according to some authors; the latter or sclerotic being formed as early as the dura mater in the fetus, is remarkably thick and strong, while the envelope of the nerve is exceedingly delicate. The pia mater envelopes the nerve also to the eye-ball, where it likewise ceases, and does not form the choroid, or any other membrane. Monro describes it as entering with the nerve, and forming the membranous expanse between the choroid and retina. But this mania of making one part form another appears truly absurd, when we consider, that in the early fetus, vessels are distributed to every organ and to every texture of the body, in order to secrete them; so that the heart and arteries, modified by the nerves, are the only sources of formation.

I shall now proceed to describe the humours of the eye, which are three in number; the aqueous, the crystalline, and the vitreous.

The aqueous humour is situated between the cornea *f* and the crystalline lens *l*, as will be easily understood by examining the enlarged view of the eye, *Fig.* 5, Plate XII., which is a vertical section, wherein the lens has been left entire. It is divided into two chambers; that marked B, which is situated between the concavity of the cornea *f* and the anterior surface of the iris *i*, is named the anterior chamber, and is the larger of the two; while that marked P, which is contained between the posterior surface of the iris *i*, and the anterior surface of the capsule of the lens *l*, together with the ciliary processes *n*, is termed the posterior chamber of the aqueous humour, and is so small that the iris appears to be in contact with the lens.* The fluid undulates freely from the one chamber to the other through the medium of the pupil. This humour consists of only four or five drops of a watery fluid, possessing powerful solvent qualities, supposed to be secreted by a membrane which invests the cornea, the iris, the ciliary processes, and the capsule of the crystalline lens, constituting a serous pouch. This membrane, I have already stated, can be seen on the cornea, but not on the other surfaces.

The crystalline humour or lens, marked *l* in *Figs.* 4, 5, 6, 9, 12, 13, and 14, is situated immediately behind the posterior chamber P of the aqueous humour, and anterior to the vitreous *o*, in a recess of the latter of which it is imbedded, and surrounded by the ciliary processes *n*, and its own peculiar capsule. In *Fig.* 12, the lens *l*, together with the vitreous humour *o*, having the impres-

* This part should be kept in view in inflammation of the eye, so as to account for the adhesion which so frequently occurs between these parts; and also with regard to some of the operations, as depression and reclination of the lens.

sion of the ciliary folds *m*, is removed from the case formed by the tunics of the eye, which figure compared with *Figs.* 4 and 5, vertical sections of the eye, in which the lens has been left entire, enables us to have a clear conception of the lens. In *Figs.* 4 and 5 it is also seen to be immediately behind the iris *i* and its pupil *p*, there being little or no interval of space between these.* The lens is an oblate spheroid—seen by examining *Figs.* 13 and 14, figure 13 being an anterior, and figure 14 a posterior view, the latter of which is much more convex than the former, and is entirely imbedded in the vitreous humour. This difference is better exemplified in *Figs.* 4 and 5. The lens is remarkably transparent in the healthy eye; the exterior portion is soft like jelly, and may be removed by gently squeezing the lens between the fingers, leaving a central nucleus, of the consistence of slightly softened wax. In its transparent condition no fibres are observed; but when opaque, it exhibits a fibrous structure, having a radiated appearance, which is supposed to be muscular.

* The precise situation and relation of the lens to the contiguous objects, should be thoroughly understood by the operator. These are most faithfully delineated in *Fig.* 4, having compared this representation more than once with nature, in order to be certain of its accuracy. The iris does not extend so as to form a plain or flat surface across the aqueous humour, but is slightly convex anteriorly or dermad where it looks to the cornea, and concave posteriorly or centrad when it looks to the lens. In consequence of the anterior convex surface of the lens projecting beyond the level of the vitreous humour and ciliary processes, this is of necessity the case, otherwise the uveal or posterior surface of the iris with its pupillary margin would touch the lens in all its multifarious movements. It may be naturally asked, why I have not described the iris having a convex and concave surface; my answer is, that I had not an opportunity of again comparing *Fig.* 4 with nature, in so recent a state as to decide so important a fact, until after the description of the iris had gone to press, and I was naturally anxious to be perfectly confirmed in my ideas of so important a relative point, before delivering them to the profession.

The radiations on each side of the lens are, according to Dr. Young, ten in number.

The crystalline lens *l* is surrounded with a transparent film, named tunica crystalloidea, or capsule of the lens, which is very tough, firm, compact and elastic, its anterior portion being more so than its posterior, and requiring some force to lacerate it.* The posterior portion adheres so intimately to the membrane surrounding the vitreous humour, that they are inseparable, thus rendering it even doubtful if both exist, and giving rise to the opinion, that the whole capsule of the lens is a production or continuation of the membrana vitrea or hyaloidea; but these membranes are so dissimilar in their structures, that they seem quite different. In the fetus two membranes are observable behind the lens. The lens adheres to its capsule in two or three points, either by delicate nerves, blood-vessels, or cellular web.

A small quantity of watery fluid, named, after Morgagni, aqua, or aquula Morgagni, is situated between the capsule and the lens; and exterior to the capsule of the lens, at its marginal circumference, a small canal is perceptible, formed between this tunic and the membrana vitrea, which is named after Petit. Dr. Young, in the Bakerian lecture published in the Phil. Trans. for 1801, describes a thin glandular zone, filling up the marginal part of the capsule of the crystalline lens, which, he says, "may possibly secrete the liquid of the crystalline." He observed this glandular zone in the lower animals, particularly the partridge, but not in the human eye; from analogy, however, and from the spotted appearance of the image of a lucid point observable in one of his

* The toughness and firmness of the capsule of the lens should be kept in view by the operator.

experiments, he infers the existence of something similar in the eye of man.

The vitreous humour *o*, in *Figs.* 12, 4, and 5, is a tremulous transparent jelly, situated posterior to the crystalline lens, and surrounded by the retina, occupying therefore the greater portion of the sphere or case of the eye formed by the sclerotic coat, and forming four-fifths of the whole globe of the eye. It consists of a clear watery fluid, contained in transparent cellular cysts, and enveloped in an equally pellucid membrane, named vitrea or hyaloidea; so that by removing the cornea, iris, and lens, we can press out this humour entire from the retina, choroid, and sclerotica, like a mass of clear glass, as exemplified in *Fig.* 12; for it is not until we prick or cut this gelatinous mass, that the watery fluid, somewhat like the albumen of an egg, escapes or exudes. On the anterior or peripheral aspect of the vitreous humour, there is a concavity which receives the posterior convex surface of the crystalline lens, (which can be easily comprehended by examining *Figs.* 12, 4, and 5); and to this concave surface and its brim, the tunica crystalloidea is attached. In *Fig.* 12, the radiated zone *m* is the print of the ciliary plicæ, a few of which remain, in consequence of their adhesion to the retina, and the adhesion of this latter to the vitreous humour. Some of the blood-vessels of the retina are also observable on this vitreous humour *o*.

I shall now proceed to the description of the muscles which move the eye and its appendages; and of these, the orbicularis palpebrarum and the corrugator supercilii have been already described. The superior eye-lid has one peculiar to itself, named levator palpebræ superioris; and the eye-ball has four straight, and two oblique muscles. All these muscles, with the exception of the inferior ob-

lique, derive their origin from the margin of the optic foramen of the sphenoid bone, *i, s,* the levator palpebræ superioris, the superior oblique, and the four straight muscles.

The levator palpebræ superioris muscle,* marked L in *Figs.* 2, 3, and 4 of Plate X. of Part IX., and in *Figs.* 15 and 16 of Plate XII. of Part X., is situated immediately beneath the roof of the orbit and periorbita; in order, therefore, to display this and the other muscles and objects under description, it is necessary to break up the roof of the orbit, by removing, partly with a saw, but chiefly with a cartilage knife, or chisel and hammer, the orbitary plate of the frontal bone, and the transverse spinous process of the sphenoid bone, which enters into the formation of the foramen opticum, and foramen lacerum anterius, preserving carefully the foramina orbitaria interna, and the depression which gives attachment to the cartilaginous pulley of the superior oblique muscle. This will be readily understood on examining *Fig.* 3 of Plate X. of Part IX. When the bone has been thus broken up, if the object be to display both the nerves and the muscles, the dissector must proceed in removing the periorbita with great care, as many of the nerves adhere intimately to this membrane. He must be also prepared to encounter a considerable quantity of delicate soft adipose substance, interspersed between the muscles, nerves, and blood-vessels, that surround and supply the eye-ball, and which render the display of these objects difficult and tedious. The dissector should

* Syn. Palpebrarum secundus, oculum aperiens: Musculus parvus et tenuis palpebram attollens: Rectus: Palpebræ superioris primus: Superiorem palpebram attollens: Apertor oculi, attollens palpebram superiorem: Pyramidalis: Aperiens palpebram rectus: Le releveur propre: Orbito-palpebral: Orbito-sus-palpebral.

display on the one eye, the muscles, arteries, and veins, and on the other, the nerves; or he may examine in the first eye, the muscles, blood-vessels, and nerves generally, and in the second eye, these organs minutely.

The levator palpebræ superioris derives its origin, partly fleshy and partly tendinous, from the superior or coronal margin of the optic foramen of the sphenoid bone, becomes soon entirely fleshy, and advances immediately beneath the roof of the orbit to its margin, where it spreads on the upper surface of the tarsus, running onwards to its outer edge, and is lost in a delicate tendinous expanse or insertion. Mr. Crampton, in his Essay on Entropeon, says, that this muscle "is not inserted into the tarsus, but merely connected with it by means of the attachment of this last to the conjunctiva and to the integuments." Mr. Guthrie, in his able work on the Operative Surgery of the Eye, says, that "it would have been more correct to have said that the muscle is inserted into the conjunctiva, and into the process of the epicranium or broad ligament suspending the tarsal cartilage, to the upper edge of which the ligament is affixed." The function of this muscle is indicated by its name.

The rectus superior, or attollens oculi muscle,* marked A in *Fig.* 4 of Plate X. of Part IX., in *Fig.* 1 of Plate XI., and in *Figs.* 15 and 16 of Plate XII., is situated on the upper or coronal aspect of the eye-ball, immediately beneath or basilad to the levator palpebræ superioris L, to which it adheres; derives a tendinous origin from the

* Syn. Tertius oculum movens: Unus ex quatuor oblongis musculis: Unus ex quatuor qui rectis motibus præfecti: Ex iis qui rectis famulantur motibus: Rectus superior: Qui a physiognomicis superbus dicatur: Attollens sive superbus: Primus attollens: Superbus: Rectus attollens oculi: Elevator oculi: Elevator: Le releveur: Levator oculi: Sus-optico-spheni-scleroticien: Elevateur de l'œil.

upper or coronal aspect of the optic foramen of the sphenoid bone, soon becomes fleshy, and advances with longitudinal fibres to the eye-ball, on which it extends, running superficially or coronad to the tendon o* of the obliquus superior, to be inserted by a tendinous expanse in the sclerotic coat near its middle, or near the circumference of the eye, the tendinous striæ advancing onwards to the margin of the cornea, and being intimately connected with the sclerotic. This tendinous expanse, together with that of the other three straight muscles, is remarkably white, and appears to contribute to the formation of what is named in popular language the white of the eye. The function of this muscle is to elevate or roll the ball of the eye upwards, as its name indicates.

The obliquus superior oculi muscle,* marked O in *Figs*. 3, 4, and 2 of Plate X. of Part IX., in *Fig*. 1 of Plate XI., and in *Figs*. 15 and 16 of Plate XII. of Part X., is situated on the inner and upper aspect of the orbit, close to the periorbita; derives a tendinous origin from the same aspect of the foramen opticum of the sphenoid bone, on the inner aspect of the origin of the levator palpebræ superioris, and advances on the inner and upper aspect of the orbit, becoming fleshy in its course onwards towards its cartilaginous pulley *c*, where it again becomes tendinous; runs in a membranous sheath, marked *o* in *Fig*. 2 of Plate X., and through the pulley *c*; and afterwards extends outwards and down-

* Syn. Tertius palpebrarum: Duorum in gyrum flectentium prior: Obliquus ille qui per trochleam ducitur: Trochleæ musculus: Trochlearis: Alter ex obliquis superior, seu major: Sextus, obliquorum secundus, circumagens interior, aut superior, vel etiam major: Obliquorum, qui major est: Obliquus superior, vel trochlearis: Obliquus superior: L'oblique superieur: An gracillimus est rectus quintus, vel musculus trochlearis: Obliquus superior oculi, seu trochlearis: Optico-trochlei-scleroticien: Grand rotateur de l'œil.

wards to the ball of the eye, beneath the attollens oculi A, where it expands, to be inserted in the sclerotic coat. The action of this muscle is to rotate the eye-ball inwards and downwards, or mesiad and basilad.

Rectus internus or adductor oculi muscle,* marked a in *Fig*. 4 of Plate X. of Part IX., in *Figs*. 1 and 2 of Plate XI., and in *Fig*. 16 of Plate XII. of Part X., situated on the inner or mesial aspect of the eye-ball, between it and the inner wall of the orbit, derives a tendinous origin, in common with the depressor and abductor muscles, from the inner or mesial margin of the optic foramen of the sphenoid bone; soon becoming fleshy, it advances to the ball of the eye, along which it extends; and again becoming tendinous and expanding, is inserted in the sclerotic coat like the preceding, adhering onwards to the cornea. Its function is to adduct or to revolve the eye inwards or mesiad.

The rectus externus or abductor oculi muscle,† marked *a* in *Fig*. 4 of Plate X. of Part IX., in *Figs*. 1 and 2 of Plate XI., and in *Fig*. 16 of Plate XII. of Part X., situated on the outer aspect of the eye-ball, between it and the outer wall of the orbit, derives a tendinous origin, in common with the adductor and depressor muscles, from the outer or temporal aspect of the optic foramen of the sphenoid bone; soon becoming fleshy, it advances

* Syn. Primus oculum movens: Unus ex quatuor oblongis musculis: Unus ex quatuor qui rectis motibus præfecti: Ex iis qui rectis famulantur motibus: Rectus interior: Qui barbaris bibitorius appellatur: Adducens sive bibitorius: Tertius adducens: Bibitorius: Rectus adducens oculi: Adductor: L'adducteur: Orbito-intus-scleroticien: L'adducteur de l'œil.

† Syn. Secundus oculum movens: Unus ex quatuor oblongis musculis: Unus ex quatuor qui rectis motibus præfecti: Ex iis qui rectis famulantur motibus: Rectus exterior: Quem indignatorium appellant: Abducens, sive indignatorius: Quartus abducens: Iracundus: Rectus abducens oculi: Abductor: L'abducteur: Orbito-extus-scleroticien: L'abducteur de l'œil.

between the orbit and the eye-ball, adhering to the latter, in the sclerotic coat of which it is inserted onwards to the cornea. Its function is to abduct, or to revolve the eye outwards or temporad.

The obliquus inferior oculi muscle,* marked *i* in *Fig.* 2 of Plate X. of Part IX., and *o* in *Fig.* 2 of Plate XI. of Part X., situated between the ball of the eye and the floor of the orbit, derives a tendinous origin from the margin of the orbitary process of the superior maxillary bone (see Part I. Plate VI. *Fig.* 15, letter *r*); ascends to the outer and under surface of the ball of the eye, running superficial or basilar to the depressor, and is inserted by a tendinous expanse in the sclerotic coat. Its action is the reverse of the superior, being its antagonist rotator, rotating the eye-ball outwards and upwards, or temporad and coronad.

Rectus inferior or depressor oculi muscle,† marked *d* in *Fig.* 2 of Plate XI. of Part X., situated between the ball of the eye and the floor of the orbit, derives a tendinous origin, in common with the abductor and adductor muscles, from the inferior or basilar aspect of the optic foramen of the sphenoid bone; becoming immediately fleshy, it advances beneath the eye-ball, to which it adheres, when becoming again tendinous and spreading, it is inserted, like the attollens, in the sclerotic coat onwards as far as the cornea. It runs between the inferior oblique and the eye-ball. The action of this muscle is to depress, or

* Syn. Quintus oculi: Sextus oculi: Obliquus alter brevis: Obliquus inferius: Inferior seu minor obliquus: Obliquus minor: L'oblique inferieur: Petit rotateur de l'œil.

† Syn. Quartus oculum movens: Unus ex quatuor oblongis musculus: Unus ex quatuor qui rectis motibus præfecti: Ex iis qui rectis famulantur motibus: Rectus inferior: Qui humilis vocatur: Deprimens sive humilis: Rectus deprimens oculi: Secundus sive depressor: Humilis: Depressor: Deprimens: L'abaisseur: Sous-opti-spheno-scleroticien: L'abaisseur de l'œil.

to roll or revolve the eye-ball downwards being the antagonist of the attollens.

These four recti muscles send their tendinous expansions over the anterior aspect of the sclerotic coat, from about the middle onwards to the cornea, meeting with each other so as to form an even layer, which, as already mentioned, contributes chiefly to form what is named in popular language the white of the eye.

The musculus lachrymalis, lately discovered by Dr. Horner* of Philadelphia, marked l in *Fig.* 3 of Plate XI., where the eye-lids U, *u*, are turned outwards and forwards, is situated at the inner angle of the orbit, behind or centrad to the lachrymal sac and canals, to which it adheres. It is of an oblong shape, derives its origin from the posterior surface of the os lachrymale, near the plane surface of the ethmoid bone (see Part I. Plate IV. *Fig.* 1, dig. 17), by a vertical arrangement of fibres, which adhering to the lachrymal sac, advance in a parallel order outwards or temporad, dividing into two fasciculi at the angle of junction of the eye-lids, each bundle of fibres proceeding along one of the canaliculi lachrymales outwards to its punctum, where it terminates or is inserted. The superior fasciculus of fibres is blended with the orbicularis palpebrarum. The function of this muscle, according to Horner, is "to draw in the puncta and to keep the edges of the eye-lids properly adjusted to the ball of the eye," &c.; while, according to Trasmondi,† who has discovered the nerves which influence this muscle, its function is to act upon the lachrymal sac and canals, to compress the caruncula lachrymalis, so as to favour the excretion of the matter secreted by its glandular

* London Medical Repository, vol. xviii. p. 32.

† Melanges de Chirurgie étrangere. Genève, 1824, p. 415.

cryptæ, and also to render tense or relax the membrane of the lachrymal sac, so as to augment or diminish the bottom of the sac, and hence to press the tears down into the nasal duct. My own opinion is, that it performs all these actions, and also directs the tears into the puncta, and presses the lachrymal canals, so as to conduct and direct the tears into the sac.

The eye, with its appendages, is almost exclusively supplied with blood by the ophthalmic artery, which is a branch of the internal carotid, as described in Part VIII., p. 36, and seen in Plate XI. of the same Part, marked *o*. This artery, seen also in Plate XII. of Part X., *Figs.* 15 and 16, marked *o*, is observed to derive its origin from the internal carotid 19, and to enter the orbit with the optic nerve 2,* at the optic foramen, enveloped in a sheath of the dura mater; it then runs tortuously around the optic nerve from beneath upwards, and over it to the mesial or inner wall of the orbit onwards to the nose, emerging between the cartilaginous pulley *c* of the superior oblique muscle, and the ligament common to the tarsi, where it inosculates with the facial artery *c*, as delineated in Plate X. of Part II., and with the infra-orbitary artery. In this course the ophthalmic artery gives origin to a number of branches, as the lachrymal, the central artery of the retina, the supra-orbital, the ciliary, the muscular, the ethmoidal, the palpebral, the frontal, and the nasal. This artery does not always run in the first instance beneath the optic nerve, for it proceeds at once above or coronad to it.

The lachrymal branch 7 is one of the first and largest given off, and proceeds along the abductor muscle *a* to

* The close proximity of the optic nerve to the internal carotid and ophthalmic arteries, should be kept in view in diseases of the eye, as amaurosis, &c.

the lachrymal gland *q*, which it supplies, sending twigs also to the upper and lower eye-lids, which inosculate with the palpebral arteries. In this course the lachrymal sends branches to the abductor muscle and the os malæ, the latter of which they pierce, and inosculate with the deep temporal arteries. This lachrymal branch is sometimes double, and occasionally the meningeal of the internal maxillary sends a branch to the gland through the foramen lacerum anterius.

The central artery of the retina, marked *k* in *Fig.* 5 of Plate XII., is a very small branch, which is early sent off from the ophthalmic artery, and soon pierces the optic nerve, running in its centre onwards through the porus opticus to the interior or central surface of the retina, where it divides into a number of minute twigs, connected by a very fine cellular web, as illustrated in *Fig.* 11. One of its minute twigs enters the substance of the vitreous humour, supplies the tunica hyaloidea, and afterwards advances to the capsule of the crystalline lens. This central artery of the retina is occasionally a subordinate, not a direct branch from the ophthalmic.

The supra-orbital or frontal branch, marked 91 in *Fig.* 15 of Plate XII. of Part X., and in Plate X. of Part II., derives its origin from the outer or temporal aspect of the ophthalmic artery in its course along the mesial or inner wall of the orbit, and at once ascends to the periorbita, and runs between it and the levator palpebræ superioris muscle L, in company with the frontal nerve, onwards to the superciliary foramen, where it mounts and runs backwards on the forehead, still in company with the nerve, as delineated in Plate X. of Part II., and is distributed on the frontal bone, the orbicularis palpebrarum, the corrugator supercilii, the occipito-frontalis, and integuments, and inosculates with the temporal artery *g*.

This is generally the largest branch of the ophthalmic artery, and in this course supplies the attollens oculi A, a, the levator palpebræ superioris L, the trochlea *c* of the superior oblique muscle O, the objects at the inner canthus of the orbit, and the superior eye-lid. These latter twigs inosculate with the facial artery of the external carotid.

The ciliary arteries, marked *d* in *Figs.* 16, 1, 8, and 10, of Plate XII. of Part X., derive their origin both from the trunk of the ophthalmic artery and from some of its branches, as the muscular, the supra-orbital, and ethmoidal; they are very small, numerous, and irregular in number; they vary from 6 to 12 in number; encircle the optic nerve in a tortuous spiral manner, inosculating and separating from each other; and on their arrival at the sclerotic coat, they are increased in number to 20 or 30. They pierce the sclerotic coat a few lines anterior or dermal to the optic nerve, and the greater number are at once distributed on the choroid coat, and are named the short ciliary arteries;* while one or two of each side, as exemplified in *Fig.* 8, run onwards between the sclerotic *s* and choroid *b* coats to the ciliary zone, which they supply, and afterwards pierce the ciliary ligament, subdivide and form a beautiful plexus of vessels, like that of the superior mesenteric artery on the small intestines, around the ciliary margin of the iris; where they inosculate with other small arteries sent off from the muscular branches of the ophthalmic, which pierce the sclerotic a line or two behind the cornea, as represented in *Fig.* 1, marked 8. From this circular plexus of arteries others arise, which inosculate and subdivide in the same manner, forming smaller and smaller circles around the iris on its uveal aspect onwards near to the pupillary margin,

* Syn. Les artères ciliaires courtes, ou postérieures, uvéales.

These anterior arteries send also branches to the ciliary folds. These long branches, which run between the sclerotic and choroid coats, are termed the long ciliary arteries;* and those which pierce the sclerotic near the cornea, are styled the anterior ciliary arteries. The long ciliary arteries are more regular in their origin from the trunk of the ophthalmic, and pierce the sclerotic coat further from the optic nerve, than the short ciliary arteries.

The muscular branches are very irregular both in their origin and number; I have already mentioned, that the supra-orbital artery supplies the attollens oculi and levator palpebræ muscles, and the lachrymal artery the abductor oculi muscle. A small branch in general accompanies one of the divisions of the third pair of nerves to the muscles, and there is usually a long inferior branch which supplies the depressor and inferior oblique muscles. These muscular branches supply the adipose substance.

The ethmoidal branch, marked 9 in *Figs*. 15 and 16 of Plate XII. of Part X., derives its origin from the mesial or inner aspect of the ophthalmic artery; enters the nares at the foramen orbitarium internum posterius, to be distributed on the mucous membrane of the ethmoidal cells, and that of the nares, inosculating with the nasal branches of the internal maxillary artery, as described in Part II., pages 46 and 47, also in Part IX., page 54. Another ethmoidal branch, marked 10 in *Figs*. 15 and 16 of Plate XI. of Part X., is given off by the ophthalmic artery, which enters the nares at the foramen orbitarium internum anterius, and also supplies the mucous membrane of the ethmoidal cells, and that of the nares, (see page 54 of Part IX.)

* Syn. Les artères ciliaires longues, iriennes.

The palpebral branches are small arteries, deriving their origin where the ophthalmic emerges between the pulley of the superior oblique, and the ligament common to the tarsi, and proceed to supply the palpebræ and tarsi, forming arches near the margins of the eye-lids, and sending branches to the ciliary glands, the conjunctiva, the caruncula lachrymalis, saccus lachrymalis, musculus lachrymalis, and orbicularis palpebrarum; inosculating with the supra-orbital, infra-orbitary, facial, and temporal arteries.

The frontal branch emerges from the orbit between the pulley of the superior oblique, and ligament common to the tarsi, and ascends on the forehead, dividing into small twigs that supply the corrugator supercilii, and occipito-frontalis muscles, inosculating with the supra-orbital artery.

The nasal branch is the continuation of the ophthalmic, and has therefore been already described onwards to the nose, along the side of which it descends to inosculate with the facial artery, as delineated in Plate X. of Part II.; and in this course supplies the lachrymal sac, the musculus lachrymalis, and the lower eye-lid.

Although I have described these minute branches of the ophthalmic artery in this manner, the student must not expect regularity of origin, or even of distribution; it appears sufficient to find the course of the trunk, and branches supplying the parts in its progress. Dr. Barclay describes only the course of the trunk, mentioning the parts which its branches supply.

The blood which is circulated by the ophthalmic artery and its branches, is returned to the cranium by the ophthalmic vein, the branches of which are nearly the same as those of the artery, and have almost a similar distribution.

The frontal vein, which returns the blood of the frontal, nasal, and supra-orbital arteries, and part of that circulated by the palpebral branches, has been already described in p. 49 of Part II. and is marked *z*, in Plate X. of the same Part. A free communication is established between this vein, and the beginning of the ophthalmic vein, marked V in *Figs.* 15 and 16 of Plate XII. of Part X., which commences at the inner angle of the eye, between the pulley of the superior oblique, and the ligament common to the tarsi, and accompanies the ophthalmic artery *o*, running backwards or centrad along the inner or mesial wall of the orbit across the optic nerve, between it and the attollens oculi muscle to the outer or temporal aspect of the latter, and between it and the abductor oculi, to enter the cranium at the foramen lacerum anterius, there joining the cavernous sinus; the coats of the ophthalmic vein, or sinus, as it is frequently named, forming the anterior commencement of the cavernous sinus. In this course the ophthalmic vein V receives the ethmoidal veins *w*, several muscular veins *x*, the lachrymal vein *y*, the ciliary veins *h*, and the vena centralis retinæ *z*.

The ethmoidal, the muscular, and the lachrymal are the simple venæ comites of their respective arteries, but the ciliary veins have a peculiar course. These begin on the uveal aspect of the iris, near the pupillary margin, running in a radiating manner backwards to the ciliary ligament, which they pierce, so as to arrive on the sclerotic aspect of the choroid coat, where they terminate in that beautiful arrangement of small veins named the venulæ, or vasa vorticosa, marked *h* in *Fig.* 8 of Plate XII. These venulæ vorticosæ collect the blood from the iris, the ciliary plicæ, and the whole of the choroid coat, and emerge piercing the sclerotic coat in two or more trunks, which proceed backwards, or centrad, to terminate in the ophthalmic vein.

Other veins are described accompanying the ciliary arteries, and named the long ciliary veins, while others again are described accompanying the anterior ciliary arteries, and termed the anterior ciliary veins; neither of these last, however, were injected in the eyes from which these diagrams were taken, and consequently are not delineated.

The venula centralis retinæ, marked *z* in *Figs.* 4 and 5, begins near the termination of the retina, collecting the blood circulated by its artery, inosculating with the ciliary veins, and its own branches, and congregating its branches, returns to the porus opticus, to enter the nerve in company with its artery, along which it runs for some length, and then emerges and joins either the ophthalmic vein, or runs backwards between the abductor and depressor muscles, entering the cranium at the foramen lacerum anterius, to terminate in the cavernous sinus.

The nerves which proceed to the eye and its appendages, are the optic, the motor oculi, the pathetic, the ophthalmic branch of the trigeminus, and the abducens.

I shall describe these nerves in the order in which they present themselves in dissection. When the roof of the orbit is broken up, as in *Fig.* 3 of Plate X. of Part IX., the nerves which appear nearly on a level, are the pathetic 4, the twigs *n*, *f*, *l*, of the ophthalmic branch 1, of the trigeminus 5, with the motor oculi 3. These, with the exception of the motor 3, adhere so intimately with the dura mater D within the cranium, and with the periorbita in the orbit without the cranium, that it requires great care and much patience to preserve them. A great quantity of delicate soft adipose substance is also found giving support to these nerves, which likewise renders their dissection difficult and tedious.

The first nerve to be investigated is the fourth, or pathetic 4,* the origin of which has been already described in page 30 of Part VIII., and represented in *Fig.* 7 of Plate VII., in Plates X. and XI., and in *Fig.* 2 of Plate XII. of the same Part; it enters the fold of the tentorium, passes through the cavernous sinus, adhering closely to the dura mater; emerges at the foramen lacerum anterius, (see Part I., Plate V., *Figs.* 9 and 10), forming a junction with the ophthalmic branch 1, of the trigeminus 5, as seen in *Fig.* 3 of Plate X. of Part IX., and almost immediately separates and runs towards the inner or mesial wall of the orbit, to be distributed on the superior oblique muscle O.

The first or ophthalmic branch 1, of the trigeminus 5, ought to be next investigated. The origin and course of the trigeminal nerve 5 to the cavernous sinus has been already described in page 31 of Part VIII., and delineated in *Fig.* 7 of Plate VII., and in Plates X. and XI. of the same Part, marked 5. In the cavernous sinus, the fifth or trigeminal nerve 5, sends small threads to unite with the great intercostal nerve, and forms a peculiar plexus or ganglion, named Casserian,† marked G in *Fig.* 3 of Plate X. of Part IX., and then divides into its three branches, marked with the digits 1, 2*, 3*. These nerves adhere intimately to the dura mater. The first or ophthalmic branch 1, the smallest of the three, originates from the upper or coronal aspect of the ganglion, and proceeds to the foramen lacerum anterius of the sphenoid bone, (mark-

* Syn. Nervus oculo-muscularis superior, seu minimus, seu musculi oculi superioris, seu par cerebrale quartum: Le nerve moteur supérieur ou interne: Nerf moteur interne, nerf oculo-musculaire interne.

† Syn. Ganglion semilunare: Plexus gangliformis: Intumescentia ganglio affinis: Plexus retiformis: Tœnia nervosa: Intumescentia semilunaris: Aggerlunatus: Armilla.

ed 2 in *Fig.* 10 of Plate V. of Part I.); forms a junction with the fourth, or pathetic nerve 4, on the outer or temporal aspect of which it runs, and also on the outer and upper, or temporal and coronal aspect, with regard to the third pair, marked 3; and then entering the orbit, it divides into three conspicuous twigs, marked *n*, *f*, *l*, the nasal, frontal, and lachrymal. Sometimes it divides only into two twigs, in which case the frontal gives origin to the lachrymal.

The frontal nerve,* marked *f*, is the largest of the three, proceeds, united at first with the pathetic 4, and adhering to the periorbita, superficially to the levator palpebræ superioris muscle L, onwards to the superciliary foramen, dividing in this course into the supra-trochlear twig *p*, and the proper frontal twig *f*. Before this division of the frontal nerve, it not unfrequently gives origin to a small filament, which unites with the infra-trochlear twig of the nasal branch, and enters the frontal sinus. The supra-trochlear twig *p* proceeds along the inner or mesial wall of the orbit, to the cartilaginous pulley *c*, in *Fig.* 4, superior or coronad to which it advances out of the orbit, and is then named internal frontal twig, and is distributed on the corrugator supercilii, the orbicularis palpebrarum, the occipito-frontalis, and the skin, and also unites with the threads of the infra-trochlearis and the proper frontal nerve. The proper frontal branch *f*† proceeds out of the orbit at the superciliary foramen, sometimes single, but more commonly in two or more filaments, which ascend over the superciliary ridge on the forehead, to supply the skin of the eye-brow and the occipito-frontalis muscle, as delineated in Plate X. of Part II., seen accompanying the frontal artery, marked 91, where it ascends

* Syn. Le nerve palpebro-frontal.

† Syn. External frontal nerve.

to the vertex, forming in its course junctions with the facial nerve. As this nerve emerges from the orbit, it sends twigs to the orbicularis palpebrarum muscle, and some of its threads do not pass through the foramen.

The lachrymal nerve, marked *l* in *Figs.* 3 and 4 of Plate X. of Part IX., and in *Fig.* 1 of Plate XI. of Part X., the smallest of the three branches, proceeds outwards or temporad, adhering to the periorbita, and running on the abductor oculi muscle *a*, and delicate adipose substance, onwards to the lachrymal gland *q*, dividing in its course into two or three twigs. The interior or mesial twig enters the gland, subdividing into many filaments to supply its substance; but others emerge from the gland, and are distributed on the integuments of the upper eye-lid and forehead, forming junctions with the facial and frontal nerves. The exterior or temporal twig proceeds through the gland, and unites with a subcutaneous twig of the superior maxillary nerve, which enters the orbit at the spheno-maxillary fissure, and unites with a twig of the deep temporal branch of the inferior maxillary nerve. This nerve supplies the internal aspect of the superior tarsus.

The nasal nerve,* marked *n* in *Figs.* 3 and 4 of Plate X. of Part IX., and in *Fig.* 1 of Plate XI. of Part X., intermediate in size to the other two branches, is situated internal or mesial to these, running across the orbit to its mesial or inner wall. It begins, as seen in *Fig.* 1 of Plate XI., immediately where the ophthalmic nerve 1 enters the orbit, proceeds beneath the levator palpebræ superioris L, and attollens oculi A muscles, and superior or coronal to the optic nerve 2; then ascends between the attollens A and adductor a muscles, as delineated in *Fig.* 4 of Plate

* Syn. Naso-ocularis: Nasalis internus: Ophthalmicus: Ethmoidalis: Naso-lobaire.

X., running across the latter, and beneath the superior oblique muscle O, as in *Fig.* 3 of Plate X., to the foramen orbitarium internum anterius (see Part I. Plate IV. *Fig.* 1). At this aperture the nerve enters the cranial cavity, runs along the cribriform lamella *a* of the ethmoid bone, emerging out of one of its anterior foramina, and descending into the nares along the cartilaginous septum onwards to the apex of the nose, where it anastomoses with twigs of the superior maxillary and facial nerves.

In this course the nasal nerve gives origin to several twigs. Almost at its very commencement, it sends off a twig, named by some ramus ciliaris, which contributes to form the lenticular ganglion, marked *g* in *Fig.* 1 of Plate XI. This twig is occasionally double. In its progress onwards, it not unfrequently gives origin to one or more distinct ciliary nerves, and even before sending off the twig to form the lenticular ganglion, it gives origin to one or two threads which unite with the third pair 3. As the nerve proceeds towards the internal anterior orbitary foramen, it gives origin to a twig which advances along the inner wall of the orbit, beneath the obliquus superior and adductor muscles, to the pulley *c*, in *Fig.* 4 of Plate X., and in *Fig.* 1 of Plate XI., which is named the nervus infra-trochlearis. This nerve, after sending twigs to the pulley and to the musculus lachrymalis, emerges out of the orbit, supplying the conjunctiva, the caruncula lachrymalis, saccus lachrymalis, orbicularis palpebrarum, occipito-frontalis, and the skin of the nose; anastomosing with the supra-orbital, the facial, and the infra-orbitary nerves. In the nares, the nasal nerve supplies the frontal sinus, and the Schneiderian membrane investing the ethmoid bone; and on the exterior of the nares, it sends twigs to the ala nasi. This nasal nerve, in very rare instances, receives its origin from the sixth pair

of nerves; and in nearly equally rare instances, it has not contributed to the formation of the lenticular ganglion.

The third pair of nerves, or motores oculorum,* marked 3 in *Fig.* 7 of Plate VII., in Plates X. and XI. of Part VIII., in *Figs.* 3 and 4 of Plate X. of Part IX., and in *Figs.* 1 and 2 of Plate XI. of Part X., have been already described in page 30 of Part VIII., from their origin to their entrance in the cavernous sinus. In this sinus or vein, the motor oculi nerve proceeds exterior or lateral to the internal carotid artery 19, emerges at the foramen lacerum anterius, lying beneath and internal, or mesial and basilar to the pathetic 4, and the ophthalmic branch 1 of the trigeminal nerve 5, and enters the orbit between the attollens A and abductor oculi *a* muscles, on the outer or temporal aspect of the optic nerve 2, and almost immediately divides into two conspicuous branches, a superior and an inferior. The superior, which is the smaller of the two, as represented in *Fig.* 1 of Plate XI., runs superficially or coronad of the nasal branch *n* of the ophthalmic division of the fifth pair, and soon divides into two twigs, marked I and *z*; the former I, proceeding to be distributed on the levator palpebræ superioris muscle L, and the latter *z*, to be ramified on the attollens oculi muscle A. From an inadvertency, the twig I is marked with the digits 20 in *Fig.* 4 of Plate X. of Part IX. This superior branch generally forms a junction with the nasal nerve *n*, and not unfrequently pierces the attollens oculi to arrive at the levator palpebræ.

The inferior branch, the larger of the two, runs first on the outer or temporal aspect of the optic nerve 2, and

* Syn. Nervus oculo-muscularis inferior, seu medius, seu oculo-motorius, seu par tertium : Le nerf moteur commun : Moteur oculaire commun : Le nerf moteur commun : Le nerf oculo-musculaire commun.

then beneath or basilad to it, and divides into three twigs marked, 𝔞, 𝔡, and 𝔬, in *Fig.* 2 of Plate XI. In this figure, the optic nerve is turned forwards and outwards together with the eye-ball, in order to bring these nerves into view. In *Fig.* 1 of the same plate these objects are in their natural position and relation to each other. The twig marked 𝔞 proceeds basilad or beneath the optic nerve 2, to the inner aspect of the orbit, and is distributed on the adductor oculi muscle a. The middle twig 𝔡, 𝔡, consisting of two filaments, proceeds straight forwards to be ramified on the depressor oculi muscle *d*. The external twig 𝔬 runs along the outer or temporal aspect of the optic nerve 2, and a little beneath or basilad, onwards to the obliquus inferior oculi muscle *o*, on which it is distributed. In its course, this last twig 𝔬 gives origin to a very short filament, which contributes to form the lenticular ganglion *g*, as represented in *Fig.* 1 of Plate XI.

This lenticular ganglion then is generally formed by this long slender branch 𝔬 of the third pair, and the nasal branch *n* of the ophthalmic nerve of the fifth pair; the former of which is observed to send a very short nerve, which frequently consists of several filaments; while the latter sends a long slender twig, as represented in *Fig.* 1 of Plate XI. It rests on the outer or temporal aspect of the optic nerve 2, between the attollens A, and the abductor oculi *a* muscles, as represented in *Fig.* 4 of Plate X.; is of a reddish tinge, and is so encompassed with delicate soft adipose substance, that it is very liable to be removed in dissection. The ciliary nerves, varying in number and in arrangement, proceed from this ganglion; sometimes they run individually, as in *Fig.* 4 of Plate X., and in *Figs.* 1 and 2 of Plate XI.; at other times they form two or three fasciculi: when two, the superior fasciculus adhering to the optic nerve consists sometimes

of three and sometimes of six twigs; the inferior fasciculus, which is generally the larger, consists sometimes of six, and sometimes of from eight to ten twigs, and does not adhere to the optic nerve, but descends downwards and outwards. These twelve or sixteen, and occasionally twenty ciliary nerves, marked *c* in *Fig.* 8 of Plate XII., proceed individually along the optic nerve to the sclerotic coat, which they pierce near the optic nerve 2, or between this and the middle of the eye-ball, and run between this tunic and the choroid coat onwards to the iris. These nervous filaments seldom or ever unite in their course to the iris, and on their arrival at the ciliary ligament they generally divide into two threads, which describe an acute angle, and advance to the anterior surface of the iris, where they run in a radiated manner onwards to the pupil, having trifling enlargements in their course, which are supposed to be ganglia.

Some authors describe these ciliary nerves as not affording any threads to the choroid coat in their progress; but this appears fallacious, for when we lift gently up any of these ciliary nerves, we find delicate threads adhering and piercing the choroid coat; besides, it is contrary to the nature of nerves to run along any organ or membrane without affording to it branches. The lenticular ganglion is said to receive nervous threads from the great sympathetic nerve. The ciliary nerve which proceeds direct from the nasal nerve, enters the eye-ball about the middle of the sclerotic coat, and unites with these ciliary nerves just described, and advances together with them onwards to the iris.

The abducens or sixth nerve,* marked with the digit 6, in *Fig.* 7 of Plate VII., Plates X. and XI., and *Fig.* 2 of

* Syn. Nervus oculo-muscularis externus, seu posterior: Le nerf moteur externe: Le nerf moteur oculaire externe.

Plate XII. of Part VIII., is described in page 31 of the same Part, from its origin to its entrance in the cavernous sinus. This nerve is also represented in *Figs.* 3 and 4 of Plate X. of Part IX., and in *Figs.* 1 and 2 of Plate XI. of Part X., likewise marked 6. In *Fig.* 1 of Plate XI. of Part X., it is observed to run beneath or basilad to the tentorium *d*, and to pierce the dura mater, where it invests the cuneiform process of the occipital bone, from thence to ascend and enter the cavernous sinus, running between the motor oculi 3, and the ophthalmic branch 1 of the trigeminal nerve, and adhering to the outer or lateral aspect of the internal carotid artery 19, onwards to the foramen lacerum anterius. At this fissure it emerges from the cranium, and enters the orbit between the attollens A, and the abductor oculi *a* muscles, to be ultimately ramified on the latter of these two. In its course through the cavernous sinus, where it first touches the internal carotid artery 19, two or more soft filaments are given off, which descend along the artery to unite with the twig of the vidian nerve, marked I in *Fig.* 3 of Plate IX. of Part IX., to form the great sympathetic nerve. In this last figure, the manner of union of these nerves is distinctly delineated. In some rare instances, the abducens nerve gives origin to the nasal nerve, and not unfrequently sends a filament to the lenticular ganglion.

The second or optic nerve, represented in *Fig.* 7 of Plate VII., in Plates X. and XI., in *Fig.* 5 of Plate XII., and in Plate XIII. of Part VIII., marked 2, has been already described in page 29 of the same Part onwards to its emergence at the optic foramen of the sphenoid bone, and is observed in Plate X. of Part VIII. to emerge with the ophthalmic artery *o*. In *Figs.* 3 and 4 of Plate X. of Part IX., and in *Fig.* 1 of Plate XI. of Part X., it is seen after its entrance in the orbit, to run beneath or basilad to the

pathetic 4, the twigs *n, f, l,* of the ophthalmic branch 1, of the trigeminus 5, the motor oculi 3, and the abducens 6, and surrounded by the recti muscles A, a, *a*, *d*, together with the levator palpebræ superioris L, and obliquus superior O, muscles, and also by the ciliary nerves *c*, sent off from the lenticular ganglion *g*. The nerve advances enveloped in a strong sheath formed by the dura and pia mater, to enter the eye-ball a little towards the mesial or nasal or inner aspect, as minutely described in pages 16 and 14, in order to form the retina.

The superior maxillary nerve,* the second branch of the fifth pair, should have been described in Part IX., as therein expressed at page 55. In *Figs*. 3 and 4 of Plate X. of Part IX., and in *Fig*. 1 of Plate X. of Part X., the trigeminal nerve is observed dividing into its three branches, the ophthalmic 1, the superior maxillary 2*, and the inferior maxillary 3*, as already described in page 34. The superior maxillary nerve 2*, intermediate in size to the other two branches, descends forwards beneath the dura mater, to which it adheres, onwards to the foramen rotundum, at which it emerges from the cranium, when it immediately divides into two or more branches. The first is a small nerve named the malar, or subcutaneous of the cheek, marked *c* in *Fig*. 4 of Plate VI. of Part IX., which enters the orbit at the spheno-maxillary fissure, runs exterior or temporal to the abductor oculi muscle, uniting with the temporal twig of the lachrymal nerve, described in page 36, and advances adhering to the periorbita, onwards to the middle of the os malæ, through a foramen of which it emerges on the cheek, to supply the orbicularis palpebrarum muscle, and integuments of the cheek, anastomosing with the facial and the

* Syn. Nervus medius quinti paris.

infra-orbitary nerves, as delineated in *Fig.* 4 of Plate VI. of Part IX. This malar nerve frequently divides in its course, as seen in this figure; and occasionally sends filaments direct to the lachrymal gland. The superior maxillary nerve then divides into two large branches, the infra-orbitary 2, and the pterygo-palatine, the latter of which afterwards subdivides into the palatine P, and the vidian *v*, as delineated in *Figs.* 4 and 5 of Plate VI. of Part XI.

The infra-orbitary nerve, marked 2 in *Figs.* 4 and 5 of Plate VI. of Part IX., and Plate IX. of Part II., and partially described in page 65 of the latter Part, ascends in the spheno-maxillary fissure, in order to enter the infra-orbitary canal in the floor of the orbit, in which it runs, and emerges at the infra-orbitary foramen to be distributed on the face. Before entering the infra-orbitary canal, this nerve gives origin to one or two branches, named dental,* and marked *d* in *Fig.* 4 of Plate VI. of Part IX. This dental nerve *d* is observed to send off almost immediately from its anterior aspect a long slender filament, named its anterior branch, which proceeds to be distributed on the buccinator muscle; the trunk of the nerve *d*, named the posterior branch, then continues to descend on the exterior wall of the antrum maxillare, or superior maxillary bone, giving origin to filaments that supply the mucous membrane which invests that cavity, to filaments which supply the bone, the three posterior molar teeth, the gums, and the pterygoid and buccinator muscles, some of these threads uniting with the nerve that supplies the anterior teeth.

In its course along the infra-orbitary canal, the infra-

* Syn. Nervus alveolaris posterior superior: Nervi alveolares sive dentales priores.

orbitary nerve 2 is observed in *Fig.* 5 of Plate VI. to send off a small filament, marked *a*, which is named the anterior dental nerve, to distinguish it from the preceding, named in this case the posterior dental nerve. In many instances there are more than one anterior dental nerve. This nerve *a* pierces the superior maxillary bone, and sends filaments to the mucous membrane of the nose, the mucous membrane of the antrum maxillare, and descends to supply the gums, the incisive, the canine, and anterior molar teeth, forming a junction with the preceding or posterior dental nerve *d*.

The infra-orbitary nerve 2 then emerges at the infra-orbitary foramen, as described in page 65 of Part II.

The pterygo-palatine nerve,* or the trunk common to the pterygoid *v* and palatine P nerves, is described by Meckel to form before its division a round triangular or cordiform ganglion, termed ganglion Meckelii,† or ganglion spheno-palatinum, which, however, is allowed not to be always present, and I confess that I have never observed it. This pterygo-palatine nerve almost immediately divides into the two nerves, the pterygoid *v*, and the palatine P.

The palatine nerve P‡ descends in the palato-maxillary canal to the palate, and emerges at the posterior palatine foramen, running horizontally by the side of the teeth onwards to the anterior palatine foramen, as delineated in *Fig.* 1 of Plate VII. of Part IX., and anastomosing with the nasal twig of the same nerve, which descends to the palate by the incisive or anterior palatine foramen. In this course the palatine nerve gives origin to several branches, an external palatine nerve, marked *p* in

* Syn. Spheno-palatine nerve. † Memoires de Berlin, 1749, p. 84.

‡ Syn. Nervus naso-palatinus.

Fig. 4 of Plate VI. of Part IX., which not unfrequently arises by more than one branch,* that descends behind the bulbous process of the superior maxillary bone to the velum palati, onwards to the uvula *f*, supplying in this progress the gums, the pterygoid muscles, the levator and tensor palati and azygos uvulæ muscles, and also the glandular and mucous structures of the velum and tonsils.

The palatine nerve is also observed in *Figs.* 4 and 5 to give origin to small filaments near the letter P, which enter the nares at the spheno-palatine aperture, (marked *o* in *Fig.* 4 of Plate IV. of Part I.) The greater number of these are distributed on the mucous membrane which invests the mouth of the Eustachian tube, the sphenoid and palatine cells, and the bones of the nares, and are termed the superior posterior nasal nerves. One of these nerves descends along the septum narium to the foramen incisivum, which it perforates, and meets with the nerve of the opposite side, and also the termination of the trunk of the palatine nerve, forming sometimes a small ganglion in the incisive canal, named ganglion naso-palatinum.

The palatine nerve P, in *Fig.* 5 of Plate VI., is observed to give origin to three other filaments immediately beneath the letter P, which pierce the nasal lamella of the palatine bone, to be distributed on the mucous membrane investing the inferior spongy bone and floor of the nares. These are named the inferior posterior nasal nerves.

These nasal nerves form junctions with the olfactory nerves.

* Syn. Nervi palatini minores: Nervus palati minor posterior et nervus palatinus minimus exterior.

The trunk of the palatine nerve P, in *Fig.* 4 of Plate VI., is also seen to give origin to one or two other nerves that are descending to supply the pterygoid muscles and velum palati.

In the palate, the palatine nerve P divides into a number of filaments, as represented in *Fig.* 1 of Plate VII., which supply the gums and the soft palate, and anastomose with the threads of the nerve of the opposite side.

The pterygoid or vidian nerve,* marked *v* in *Figs.* 4 and 5 of Plate VI., and in *Fig.* 3 of Plate IX. of Part IX., reflected from the trunk common to this and the palatine P, enters the vidian canal of the sphenoid bone, along which it runs, and re-enters the cranium, dividing into its petrosal twig p, described in page 86 of Part IX., and its intercostal twig I, the latter of which proceeds on the outer or lateral aspect of the internal carotid artery, marked 19 in *Fig.* 3 of Plate IX., dividing and uniting with the reflected twigs of the abducens nerve 6, in order to form the great intercostal nerve 7, described in Part II., page 53. In general, this branch unites also with the trigeminal nerve. Before the pterygoid or vidian nerve enters the vidian canal, it sends off small filaments, some of which enter the spheno-palatine aperture to be distributed on the mucous membrane of the nares, anastomosing with the olfactory nerve, and are named the posterior superior nasal nerves; others of which pierce the internal pterygoid plate of the sphenoid bone, and descend to be ramified on the velum palati.

* Syn. Nervus quinti recurrens, seu anastomoticus.

ORGAN OF TOUCH.

I SHALL now proceed to the organ of touch, although, in a physiological order, it should have preceded the other senses, all of them being ultimately dependent on touch in the performance of their functions.

The immediate organ of touch consists of the whole superficies of the body, which is formed of the epidermis, the corpus mucosum, the cutis vera, the corpus cellulosum, and the corpus adiposum; together with the delicate termination of the extremes of the nerves, blood-vessels, exhalants, and commencements of the lymphatics.

The first pellicle which presents itself is named the epidermis,* and is best exemplified on the hand or foot, being there thickest. In Plate XIII. of Part X. are four views of the hand, *Figs.* 1 and 2 illustrating the epidermis. The epidermis covers the whole surface of the body, and even enters the mucous passages, as the eye, the nose, the mouth, the ear, the urethra, the vagina, and the anus; but so modified in these, that it is not easily detected, except at their commencements. The skin is therefore said to form a sac reverted upon itself, which surrounds all the organs of the body. The epidermis is a white, semi-transparent, insensible, membranous expansion, arranged in laminæ or squamæ, according to its thickness. In the negro it is of a clear greyish or cineritious colour, rather thicker, and scarcely semi-transparent. In delicate parts of the body, as the face, or glans penis, it consists of one lamina, is exceedingly thin, and even transparent; while in the palms

* Syn. Cuticle: Skarf-skin.

of the hands and soles of the feet it consists of squamæ, is remarkably thick, hard, and opaque, even in the fetus. The outer or peripheral aspect of the epidermis is rougher than the inner or central, the latter being smooth and glistening, in consequence of the moisture of the corpus mucosum. On both aspects or surfaces there are a number of rugæ, lines or wrinkles, from its receiving the impression of the various irregularities of the cutis, to which it intimately adheres; and on the interior or central, there are a number of delicate processes, which are the sheaths formed by the epidermis for the hairs that are transmitted; there are other processes, but shorter and more delicate, which are merely the points of adhesion between the epidermis and cutis vera. These are represented in *Fig.* 1, where the epidermis resembles a glove. Bichat is of opinion that these latter are the extremities of the exhalants and absorbents. Besides the hairs being transmitted through this membrane, there are small apertures or pores for the exudation of the exhalants, the excretory ducts of the glands of the skin, and for the commencements of the lymphatics. Lewenhoeck and Bichat contend that such apertures or pores exist, while Meckel and Humboldt deny their existence. These processes and foramina are best seen in a hand or foot which has been macerated for the purpose, by cautiously removing the epidermis. In *Fig.* 2, which is a view of the back of the epidermis that covers the hand, a number of foramina are observable.

The nails are those elegant appendages of the epidermis situated at the tips of the fingers, as represented in *Figs.* 1 and 2 of Plate XIII. They are of oblong shape, consisting of a root, body, sides, and a free distal margin, and formed of plates or laminæ, their outer or peripheral aspect being smooth and convex, while their inner or

central is concave and grooved, as delineated in *Fig.* 1 of Plate XIII. Even on the outer aspect there is a linear appearance. Their root and sides are firmly imbedded,. wedged, or indented in the cutis vera, as may be understood by examining *Fig.* 3; thus the epidermis is reflected so as to adhere to their outer surface, excepting at their anterior free margins, where it is attached to their inner aspect; and their inner surface adheres securely, through the medium of its grooved structure, also to the cutis vera: The nails are thus perfectly secured in order to prevent all motion.

The straight margin of the root of a nail is thinner than the rest, and is slightly serrated, apparently the more effectually to prevent mobility; and as the root shoots beyond the epidermis to become the body, there is a white semilunar spot, which is termed the lunula; but this is not invariably lunated, being in some rare cases pyramidical, the apex pointing distad. This root diminishes in size from the thumb to the little finger, and varies in magnitude in different individuals. The body of the nail is situated beyond or distad to the lunula, and has a delicate pinkish tinge; and where it projects beyond the tip of the finger, it has a free distal margin, of a whitish colour, and thicker than elsewhere. When well formed, the margin is slightly arched; but from fashion or custom the nails are variously shaped, and of different lengths. If allowed to grow, they curve towards the palm of the hand.

The nails of the toes differ from those of the hand in being squarer, with the exception of that of the great toe, and in having generally no lunula. This last appearance or lunula depends on the cutis vera beneath, and so also does the delicate pink tinge distad to it.

The nails, like the epidermis, are totally destitute of sensation or vitality.

By maceration or putrefaction we are enabled to separate the epidermis, and then we arrive at a mucous stratum of fluid between it and the cutis vera, termed the corpus mucosum.* The corpus mucosum is a homogeneous mucous semi-fluid substance, lodged between the papillæ of the cutis vera, and is described by some to consist of three or more strata or beds. Gualtier describes an external and an internal white stratum or tunic, and an intermediate one, which he denominates the brown substance in the negro; and that the external stratum is the thinnest, while the internal is the thickest. Cruickshanks found four strata in a patient who died of small-pox. But from the fluid nature of the corpus mucosum, it is very difficult to distinguish any layers even in the negro.

The cutis vera is situated beneath or centrad to the epidermis and corpus mucosum, and is represented in *Figs.* 3 and 4 of Plate XIII. This is subdivided by some anatomists into a vascular web or membrane, a papillary tissue, and a derma or dermis, which subdivision, however, appears unnecessary.

The cutis vera, like the epidermis, extends all over the surface of the body, and into the mucous passages; it constitutes the chief portion of the skin, as represented in *Fig.* 3, where, at the place of section, the integuments above the wrist-joint are everted; it is of a white colour, and solid elastic consistence; is formed of laminæ of a somewhat fibrous structure, the fibres running obliquely from within outwards, and being more open in its texture within or centrad than without or peripherad, the latter

* Syn. Rete vel reticulum Malpighi: Rete mucosum: Le réseau muqueux ou vasculaire.

of which is very dense and firm. This openness of the central aspect of the texture of the cutis, enables the nerves and arteries to enter freely its structure. This fibrous structure is most apparent on the back and the soles of the feet, where it resembles very much the fibrous cellular tissue beneath, which it evidently becomes. The cutis is thickest in the soles of the feet, the palms of the hands, and the back; thinnest in the eye-lids, the scrotum, the penis, and the labia of the female; it is thinner in the upper than in the lower extremities; and much thinner in the face than in the scalp. The cutis beneath the nails is red and vascular; is very thick, soft, and having no layers, but an appearance of longitudinal fibres to correspond with the grooves on the central surface of the nails. There are small regular spiral ridges, with corresponding grooves, in the palms of the hands, as represented in *Fig.* 4, in the soles of the feet, and margins of the lips; and there are a number of small elevations, named textus papillaris, or papillary tissue,* which seem to be the termination of the nerves and arteries, and commencement of the veins and absorbents,† at the tips of the fingers and the back of the hand, as delineated in *Figs.* 3 and 4, and also in the face. Each papilla is found to consist of two smaller papillæ, which are most conspicuous on the lips, the mamma of the female, the palmar aspect of the fingers, the plantar aspect of the toes, and the glans penis: on the lips and glans penis these papillæ are named villi, and are extremely numerous. This papillary structure, together with the whole external or peripheral surface of the cutis, is described by Mr.

* Syn. Papillæ: Papillæ nervosæ: Papillæ pyramidales.

† Fodera has revived the ancient doctrine, that exhalation and absorption depend upon the capillary state of the tissues; and Jourdan and Breschet deny the existence of inhaling or exhaling vessels on the skin.

Baynham to be covered with a very delicate vascular web, composed of a multitude of central points united by a number of anastomosing vessels, disposed with great regularity. This, however, is unquestionably only the vascular papillæ.

In several parts of the body, as, for example, at the articulations, particularly the joints of the fingers, the cutis is thrown into loose folds; also on the forehead, the scrotum, and some other parts.

In various parts of the body, as the eye-lids, the extremity of the nose, the external cartilage and meatus of the ear, the nipple of the mamma, the vagina and the anus, there are a number of sebaceous glands* imbedded in the cutis. They are mucous follicles or cryptæ, which open external to the epidermis with open mouths, like small black dots, and terminate in the cutis with culs-de-sacs.

On investigating the integuments still deeper, we find, immediately under or centrad to the cutis vera, the cellular substance,† supporting in its cells the adipose substance‡ and serous fluid, as delineated in *Fig.* 3 of Plate XIII., at the place of section above the wrist-joint, where the integuments are everted.

The cellular substance forms an envelope to the muscles, and pervades the whole body, forming the foundation or matrix of all the other organs. According to Bordeu, Meckel, Prochaska, and others, it is a coherent, homogeneous, viscous substance, scarcely solidified, and divested of form; it is the coagulable fluid in the state of coagulation, and technically named the mucous tissue. Several very interesting facts and ingenious arguments are

* Syn. Miliary glands: Mucous cryptæ.

† Syn. Tela seu textus cellulosus, cribrosus, mucosus: Membrana cellularis: Reticular substance: Tissu cellulaire: Le system muqueux.

‡ Syn. Corpus adiposum: Adeps: Pinguedo: Panniculus adiposus.

brought forward to support this theory; but what completely overturns it is, that when we take any quantity, however small, and immerse it in water hot enough to melt and remove the oleaginous matter, there remains a membranous film. On the other hand, according to Haller, Bichat, Beclard, and others, this cellular substance is correctly described to consist of an assemblage of lamellæ of soft white fibrils, the arrangement of which varies to infinity, and which form cells varying in figure and differing in magnitude, and communicating freely with each other, in such a manner that the whole cellular tissue forms only one cavity subdivided to infinity. The cellular substance is very elastic, but possesses little or no sensibility or mobility.

The cellular substance varies in quantity in various parts of the body; thus, for example, it is very abundant under the skin in some regions, as at the mamma, the nates, and mons veneris, in the female, also in the axillæ, the groins, and soles of the feet of both sexes; and is still more abundant in the pelvis. It abounds in the abdomen, as in the regions of the kidney and mesentery; in the thorax between the lamellæ of the mediastinum, and around the great vessels of the heart; and in the neck, about the carotids and lymphatic glands. In the superior extremities it is found in the course of the vessels, and between the muscles; and so also in the lower extremities, particularly around the popliteal vessels. There is very little cellular substance found about the eye-lids, penis, or scrotum; extremely little within the spinal canal; and little or none within the cranial cavity.

In the living body, the adipose matter is partly fluid and partly solid, and in some regions it is entirely the one or the other; it is of a yellowish colour, found in

masses of various forms contained in the cells of the cellular tissue; these masses being smallest immediately beneath the cutis vera, and becoming larger and larger centrad; nevertheless there are small ones mingled with the large.

The serous fluid, or serosity, is found throughout the cellular tissue, but occasionally exists without the adipose matter, as, for example, in the eye-lids and scrotum.

In the subcutaneous adipose substance a profusion of blood-vessels, chiefly veins, are seen, which are named vasa subcutanea.

The hairs are situated all over the skin or external surface of the body, with the exception of the palms of the hands and soles of the feet; but are more numerous in some places than in others, in general where the cutaneous joins the mucous structure, as at the eye-lids, the nostrils, the mouth, the external auditory tube, the anus, and the vagina. The hairs are also numerous on the scalp, the eye-brows, the axillæ, the groins, the pubes, and abdomen in both sexes, and on the breast and back of the male. The hairs in many of these places do not appear until puberty, as on the chin, the pubes, and the axillæ.

The hairs on the cheek and the forehead are the furthest separated from each other; 2dly, those in the nose, around the anus, and the extremities, are less so; 3dly, those on the pubes, axillæ, breast, abdomen, eye-brows, and eye-lashes; 4thly, those on the chin, or the beard; and lastly, those of the scalp, which are also the longest, and most numerous.

The hardest and stiffest hairs are at the external apertures of the nares, while the softest are those of the face, with the exception of the beard.

The hairs on the pubes are the thickest in diameter, next those of the axillæ, then those of the scalp, and lastly those of the eye-brows and eye-lashes.

The hairs consist of a root or bulb, a body, and a point or apex, and gradually taper from the bulb to the apex, and are slender according to their length. The bulb is soft and thick, consists of several filaments, apparently vascular, united by cellular tissue, and surrounded or enveloped by a cellular sheath, between and around which is an oleaginous fluid named the medulla of the hair. The bulb is imbedded in the cellular tissue beneath the cutis vera, with which it is connected through the medium of blood-vessels and nerves, at least this is the source of origin of the long hairs. The delicate short hairs may grow from the cutis. With respect to nerves being distributed on the roots of the hairs, Rudolphi has traced them into the bulbs of the mustaches of the seal. As the hair advances through the cutis, it acquires a sheath of epidermis, which is supposed by Albinus and others to extend to its apex; this sheath is of a whitish colour and transparent, and at the bulb consists of several laminæ.

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OF

THE LETTERS OF REFERENCE

TO

PART X.

THE EYE, AND THE VISCERA OF THE THORAX AND ABDOMEN.

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A, Levator oculi muscle
L, Levator palpebræ superioris muscle
O, Obliquus superior muscle
O*, Tendon of obliquus superior muscle
P, Pituitary gland
Y, Section of cranium

a, Adductor oculi muscle
f, Frontal twig of ophthalmic branch of fifth pair of nerves

a, Abductor oculi muscle
b, Crista galli
c, Cartilaginous pulley of superior oblique muscle
d, Tentorium
g, Lenticular ganglion
i, Infundibulum
l, Lachrymal twig of ophthalmic branch of fifth nerve
n, Nasal twig of ophthalmic branch of fifth pair of nerves
p, Supra-trochlear twig of ophthalmic branch of fifth pair of nerves
q, Lachrymal gland
z, Twig of third pair of nerves distributed on levator oculi muscle

a, Twig of third pair of nerves to adductor oculi muscle
I, Twig of third pair of nerves distributed on levator palpebræ muscle

PLATE XI. *Fig.* 1. *(Continued.)*

𝔬, Twig of third pair of nerves distributed on obliquus inferior muscle

1, Ophthalmic branch of fifth pair of nerves
2, Optic nerve
2*, Superior maxillary nerve
3, Motor oculi nerve
3*, Inferior maxillary nerve
5, Trigeminal nerve
6, Sixth or abducens nerve
19, Internal carotid artery

Fig. 2.

D, Dura mater
Y, Section of cranium

a, Adductor oculi muscle

a, Abductor oculi muscle
b, Crista galli
c, Ciliary nerves
d, Depressor oculi muscle
o, Obliquus inferior muscle
r, Reflected twig of sixth pair of nerves
z, Filament of third pair of nerves distributed on levator oculi muscle

𝔞, Twig of third pair of nerves to adductor oculi muscle

𝔡, Threads of third pair of nerves to depressor oculi muscle
𝔩, Twig of third pair of nerves distributed on levator palpebræ muscle
𝔬, Filament of third pair of nerves to inferior oblique muscle

1, Ophthalmic branch of fifth pair of nerves
2, Optic nerve
3, Motor oculi nerve
3*, Inferior maxillary nerve
5, Trigeminal nerve
6, Abducens nerve
19, Internal carotid artery

Fig. 3.

U, Upper eye-lid

l, Lachrymal muscle

u, Lower eye-lid

PLATE XII. *Fig.* 1.

c, Ciliary nerves
d, Posterior ciliary arteries
f, Cornea
h, Ciliary veins
s, Sclerotic coat

2, Optic nerve
8, Anterior ciliary arteries

Fig. 2.

Front view of the eye-ball.

Fig. 3.

Enlarged view of *Fig.* 2.

f, Cornea
i, Iris
p, Pupil
s, Sclerotic coat

Fig. 4.

Vertical section of the eye-ball, in which the crystalline lens is left entire.

Fig. 5.

Enlarged view of *Fig.* 4.

B, Anterior chamber of aqueous humour
P, Posterior chamber of aqueous humour

b, Choroid coat
f, Cornea
i, Iris
k, Arteria centralis retinæ
l, Crystalline lens
m, Ciliary folds
n, Ciliary processes
o, Vitreous humour
p, Pupil
r, Retina
s, Sclerotic coat
z, Vena centralis retinæ

2, Optic nerve

PLATE XII. *Fig.* 6.

f, Cornea
i, Iris
l, Crystalline lens
n, Ciliary processes
p, Pupil
s, Sclerotic coat

Fig. 7.

b, Choroid coat
i, Iris
m, Ciliary folds
n, Ciliary processes
p, Pupil
s, Sclerotic coat

Fig. 8.

b, Choroid coat
c, Ciliary nerves
d, Posterior ciliary arteries
f, Cornea
h, Ciliary veins
s, Sclerotic coat
2, Optic nerve

Fig. 9.

b, Choroid coat
l, Crystalline lens
m, Ciliary folds
n, Ciliary processes
r, Retina
s, Sclerotic coat

Fig. 10.

b, Choroid coat
c, Ciliary nerves
d, Posterior ciliary arteries
f, Cornea
r, Retina
s, Sclerotic coat
2, Optic nerve

Fig. 11.

S, Process of Sœmmering
b, Choroid coat
r, Retina
s, Sclerotic coat

PLATE XII. *Fig.* 12.

l, Crystalline lens
m, Impression of the ciliary folds
o, Vitreous humour

Fig. 13.

View of anterior surface of crystalline lens.

Fig. 14.

View of posterior surface of crystalline lens.

Fig. 15.

A, Levator oculi muscle
E, Eye-ball
L, Levator palpebræ superioris muscle
O, Obliquus superior oculi muscle
V, Ophthalmic vein

c, Cartilaginous pulley of superior oblique muscle
o, Ophthalmic artery
q, Lachrymal gland
w, Ethmoidal vein
y, Lachrymal vein

1, Ophthalmic branch of fifth pair of nerves
2, Optic nerve
2*, Superior maxillary nerve
3*, Inferior maxillary nerve
5, Fifth or trigeminal nerve
7, Lachrymal artery
9, Ethmoidal artery
10, Ethmoidal artery
19, Internal carotid artery
91, Supra-orbital, or frontal artery
99, Ethmoidal vein

Fig. 16.

A, Levator oculi muscle
E, Eye-ball
L, Levator palpebræ superioris muscle

PLATE XII. *Fig.* 16. (*Continued.*)

o, Obliquus superior oculi muscle
o*, Tendon of obliquus superior muscle
v, Ophthalmic vein

a, Adductor oculi muscle

a, Abductor oculi muscle
c, Cartilaginous pulley of superior oblique muscle
d, Posterior ciliary arteries
h, Ciliary veins
o, Ophthalmic artery
q, Lachrymal gland
w, Ethmoidal veins
x, Muscular veins
y, Lachrymal vein

1, Ophthalmic branch of fifth pair of nerves
2, Optic nerve
2*, Superior maxillary nerve
3*, Inferior maxillary nerve
5, Fifth or trigeminal nerve
7, Lachrymal artery
8, Anterior ciliary arteries
9, Ethmoidal artery
10, Ethmoidal artery
19, Internal carotid artery

PLATE XIII. *Fig.* 1.

Front view of the epidermis of the hand.

Fig. 2.

Back view of the epidermis of the hand.

Fig. 3.

Back view of the hand exhibiting the cutis vera.

Fig. 4.

Front view of the hand exhibiting the cutis vera.

PLATE XIV.

A, Ribs
A*, Symphysis pubis
B, Diaphragm
B*, Os sacrum
C, Os coccygis
D, Right ventricle of the heart
F, Spleen
G, Lungs
H, Left subclavian artery
I, Rectum
I*, Anus
K, Jejunum
L, Ileum
M, Triangular ligament of urethra
N, Cowper's gland
O, Bulb of urethra
P, Transverse portion of colon
T, Longitudinal muscular band of colon
X, Corpus cavernosum penis
Z, Scrotum

a, Peritoneum
b, Stomach
h, Omentum majus
i, Liver
m, Urinary bladder
r, Sphincter ani muscle
s, Arteria gastro-epiploica dextra
t, Prostate gland
u, Vesiculæ seminales
v, Vas deferens
w, contiguous to F, Arteria gastro-epiploica sinistra
w, contiguous to *f*, Ureter

c, Gluteal artery
f, Ischiadic artery
g, Left ventricle of the heart
*g**, Spermatic artery
*g***, Middle hemorrhoidal artery
k, Vesical artery
n, Catheter
z, Sigmoid flexure of colon

8, Phrenic nerve
14, Internal mammary artery

PLATE XV.

A, Ribs
A*, Pyriformis muscle
B, Diaphragm
B*, Sacrum
C, Renal artery
C*, Gluteus minimus muscle
E, Thoracic aorta
F, Spleen
F*, Gluteus maximus muscle
G, Lungs
H, Long sacro-ischiadic ligament
I, Œsophagus
I*, Rectum
I**, Anus
I***, Gluteus medius muscle
M, Caput cæcum coli
O, Ascending portion of colon
O*, Common iliac vein
P, Common iliac artery
S, Crista of the os ilium
T, Dorsal vertebræ
X, Obturator internus muscle, with gemelli muscles
Y, Kidney
Z, Tuberosity of os ischium

PLATE XV. *(Continued.)*

a, Peritoneum
b, Stomach
e, Abdominal aorta
e*, Trochanter major
f, Left branch of pulmonary artery
h, Short sacro-ischiadic ligament
i, Liver
k, Right bronchus
s, Levator ani muscle
w, Ureter
z, Diaphragmatic artery

a, Œsophageal plexus of nerves
b, Internal hemorrhoidal artery
c, Gluteal artery
f, Ischiadic artery
g, Spermatic artery
h, Internal pudic artery
i, Vena cava ascendens
p, Sacro-median artery
t, Lumbar artery
z, Sigmoid flexure of colon

1, Thoracic duct
2, Pulmonic plexus of nerves
2*, Left pulmonic veins
5*, Vena azygos
12, Intercostal arteries
15, Intercostal veins
20, Great sacro-ischiadic nerve

PLATE XVI. *Fig.* 1.

A, Cardiac orifice of stomach
B, Muscular tunic of stomach
D, Lesser arch of stomach
I, Œsophagus
T, Pyloric orifice of stomach
X, Greater extremity of stomach
c, Duodenum
p, Gastric artery
s, Arteria gastro-epiploica dextra
w, Arteria gastro-epiploica sinistra

a, Peritoneal tunic of stomach
b, Anterior or sternal aspect of stomach
b, Greater arch of stomach
x, Lesser extremity of stomach

Fig. 2.

A, Suspensory ligament of liver
B, Diaphragm
C, Round ligament of liver
D, Pancreas

PLATE XVI. *Fig.* 2. *(Continued.)*

E, Left lateral ligament of liver
F, Spleen
G, Lobulus quadratus vel anonymus
H, Pons hepatis
I, Right lobe of the liver
K, Jejunum
L, Ileum
M, Ductus communis choledochus
N, Vena portæ
P, Pancreatic duct
Q, Mesentery
R, Superior mesenteric artery
T, Pyloric orifice of the stomach
U, Superior mesenteric vein
V, Fossa umbilicalis

a Peritoneum
b, Stomach
c, Duodenum
e, Gall bladder
i, Left lobe of the liver
k, Lobulus Spigelii of liver
n, Right branch of vena portæ
q, Hepatic artery
r, Splenic artery
s, Arteria gastro-epiploica-dextra

e, Ductus cysticus
f, Ductus hepaticus
n, Left branch of vena portæ
s, Splenic vein

Fig. 3.

r, Splenic artery
s, Splenic vein

PLATE XVII. *Fig.* 1.

A, Cardiac orifice of stomach
B, Muscular tunic of stomach
D, Lesser arch of stomach
I, Œsophagus
T, Pyloric orifice of stomach

a, Peritoneal tunic of stomach
c, Duodenum

b, Greater arch of stomach
m, Mucous tunic of stomach

Fig. 2.

I, Right lobe of liver
M, Ductus communis choledochus
M*, Opening of ductus communis coledochus in duodenum
N, Vena portæ
T, Pyloric orifice of stomach
U, Superior mesenteric vein
V, Fossa umbilicalis
W, Fossa of gall bladder
Y, Lobulus caudatus

PLATE XVII. *Fig.* 2. (*Continued.*)

b, Stomach
c, Duodenum
e, Gall bladder
i, Left lobe of liver
k, Lobulus Spigelii
n, Right branch of vena portæ
p, Gastric artery
q, Hepatic artery
s, Arteria gastro-epiploica dextra

e, Ductus cysticus
f, Ductus hepaticus
i, Vena cava ascendens
n, Left branch of vena portæ
s, Splenic vein

PLATE XVIII. *Fig.* 1.

L, Ileum
Q, Mesentery
m, Mucous tunic of ileum

Fig. 2.

L, Ileum
M, Caput cœcum coli
O, Ascending portion of colon
T, Longitudinal muscular bands of colon
l, Ligament between ileum and colon

29, Appendix vermiformis

Fig. 3.

L, Ileum
T, Longitudinal muscular bands of colon

m, Mucous tunic of colon
v, Valve of colon

29, Appendix vermiformis

ERRATA AND OMISSIONS.

In page 10, last line of text, after *Figs.* 1, 3, 5, 6, 8, and 10, *read,* "of Plate XII."

In page 12, eighth line from the bottom, after *Figs.* 1, 3, 5, 6, 8, and 10, *read,* "of Plate XII."

In page 13, eleventh line from the top, after *Figs.* 5, 8, 7, 9, 10, and 11, *read,* "of Plate XII."

In page 14, eleventh line from the bottom of the text, after *Figs.* 10, 11, 4, and 5, *read,* "of Plate XII."

In page 17, sixth line from the bottom of the text, after *Figs.* 4, 5, 6, 9, 12, 13, and 14, *read,* "of Plate XII."

In page 20, third line from the top, after *Figs.* 12, 4, and 5, *read,* "of Plate XII."

In page 28, nineteenth line from the top, after "crystalline lens," *read,* "In birds and fishes, a blood-vessel is seen entering the vertex of the radiation of the lens."

In page 35, sixth line from the top, the letter italic "*f*" should be small roman "f."

In page 35, tenth line from the top, the letter italic "*f*" should be small roman "f."

In page 35, fifteenth line from the top, the letter italic "*f*" should be small roman "f."

In page 35, seventh line from the bottom, the letter italic "*f*" should be small roman "f."

In page 42, first line from the top, the letter italic "*f*" should be small roman "f."